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AUTOMOTIVE INDUSTRIES

LAND — AIR — WATER

JANUARY 1, 1938

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More of them are New Departures than any other kind.

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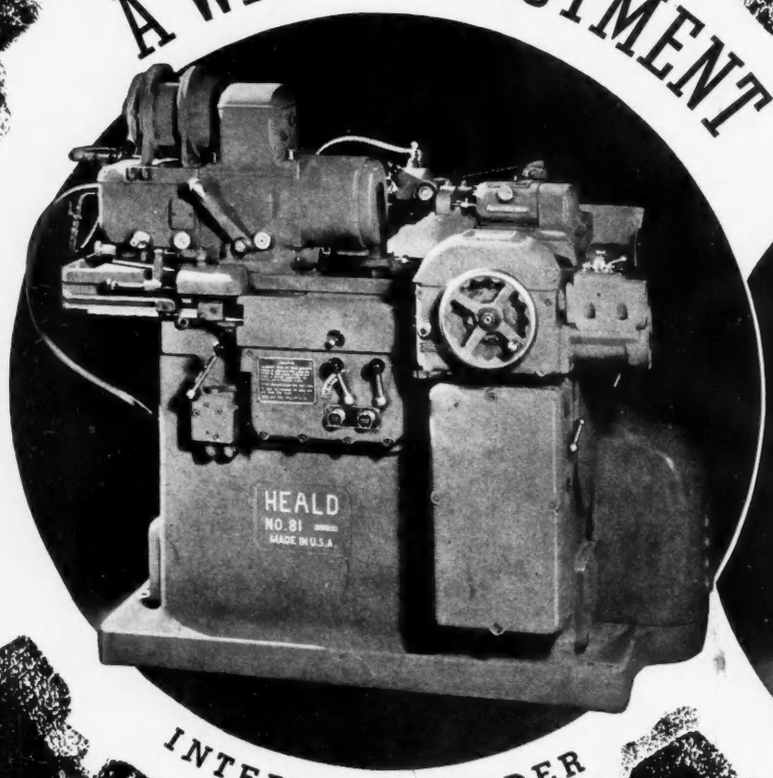

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Insure your share of business in 1938 by investigating these machines today.

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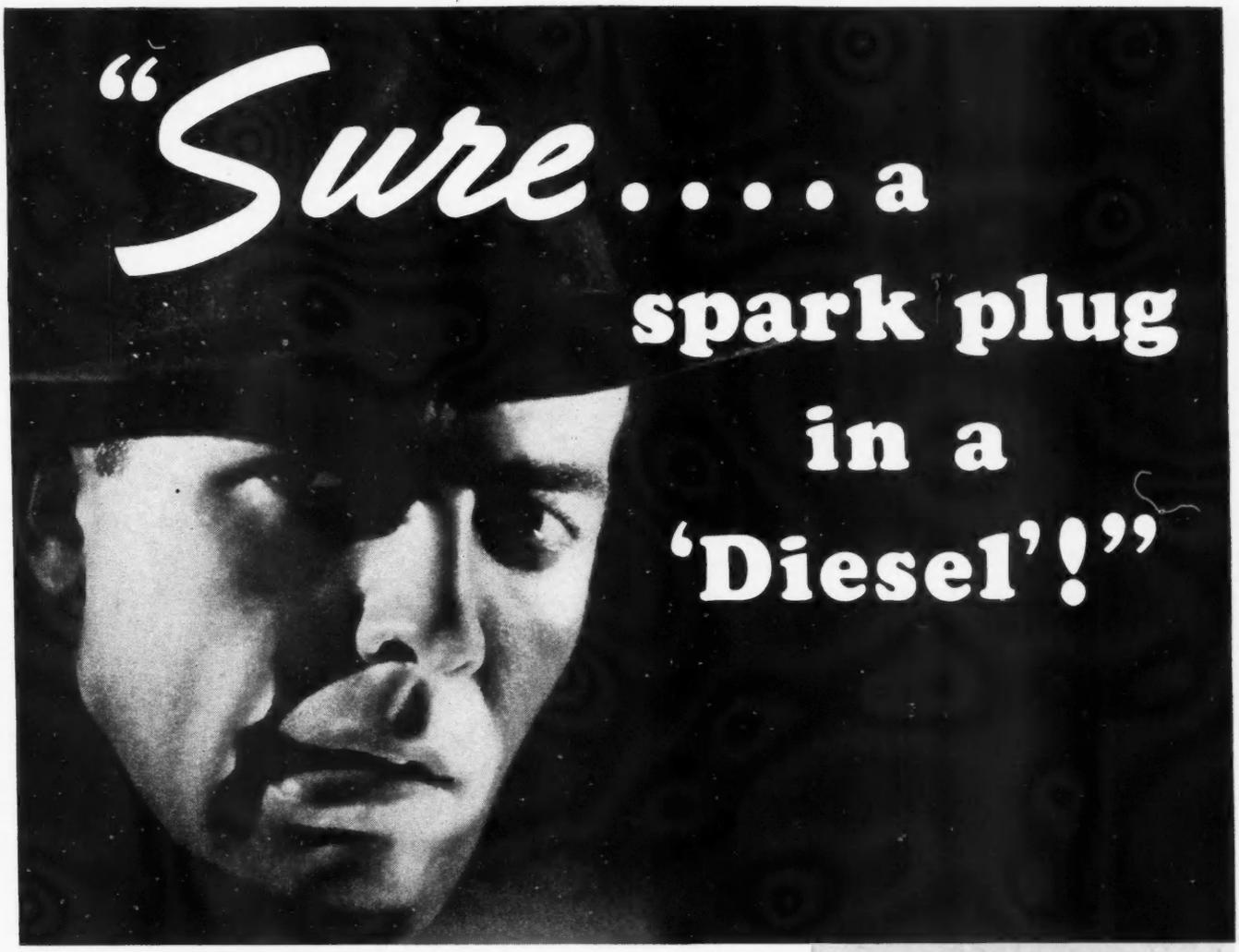

In the "plain English" of John Q. Public, if an engine burns heavy fuels . . . injected cold . . . it's a "Diesel." Let the technical man quibble and limit the term to high pressure compression ignition engines . . . "So what?" says this shovel operator. "I know what I want."

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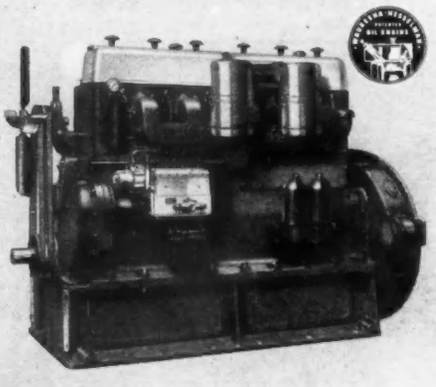

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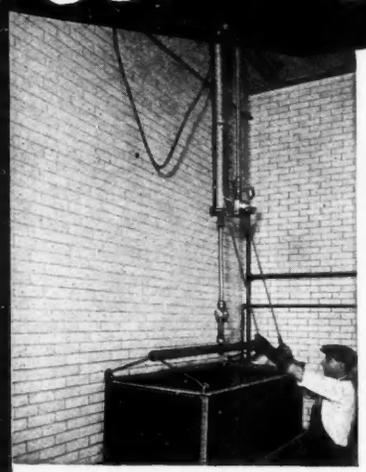

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AUTOMOTIVE INDUSTRIES

The AUTOMOBILE

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Published Weekly

Volume 78 Number 1

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AUTOMOTIVE INDUSTRIES

January 1, 1938
Vol. 78, No. 1

Uncertainty Clouds Output Horizon

Industry's Production Goal for 1938 Probably Lower; 1937 Five Million Mark Missed by Scant Margin

What has been the second biggest year on record for the automobile industry passed into history, leaving in its wake a haze of uncertainty through which even the most astute observers are unable to peer. Earlier hopes for 1938 have been wrecked by events in the political and business world. What the new year holds for the automobile business is in the laps of the gods. No one now will hazard a forecast. Only this can be said—sights are being lowered. While the 1938 target is still obscure, the industry generally is reconciled to a considerably lower objective for the coming year. There is little planning for the future and operations are on a day-to-day basis.

From present indications, the industry missed its 5,000,000 unit goal for 1937 by a scant margin of 10,000 to 15,000 vehicles. It had 330,371 units to go at the end of the first 11 months and while only a preliminary output estimate can be made for December, it looks now like the final figure for 1937 will be just a few thousand units under the round number, long considered the objective for the year.

For several weeks, the manufacturers have attempted to fit production to the needs of the retail market, but sales slipped to lower levels faster than output was contracted so that up to the holiday weeks field stocks steadily expanded. However, with the drastic curtailment of the past two weeks, the trend is believed to have been reversed. With many plants completely shut down between the holidays and those in operation practically all on part-time basis, there is little question but what output dropped below even the materially restricted sales rate.

There will be no rush to resume operations at the opening of the new year. Production will be held as near as possible to the market's requirements or slightly below so as to gradually work down burdensome dealer inventories. Some leading companies will be missing from the ranks of active producers during the first week of January. Most of the others will be on a shortened week, the three-day week prevailing. Only a rough estimate can be made at this time but from known schedules of leading companies indications are that January should account for some 225,000 cars and trucks, or about 60 per cent of the volume for January last year. General Motors plans to build 100,000 units in United States and Canadian plants. Ford has scheduled 4000 cars and trucks a day for five days a week, or a total of 84,000 units for January.

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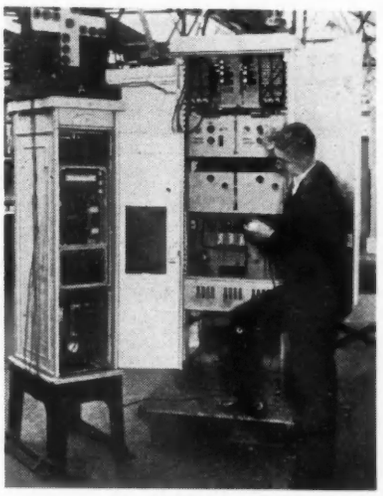


Underwood & Underwood photo

TRAFFIC ROBOT World's largest vehicle traffic control signal recently installed at Piccadilly Circus, London. The huge unit was built at the Strowger Works of the Automatic Telephone and Electric Co., Ltd., at Liverpool, England. It provides automatic control of traffic within the Circus, and of all approach roads in an immediate radius.

Ford-NLRB Case May Clarify Act

Court Test of National Labor Relations Board's Order Will Involve Detailed Interpretation

The most important case of its kind since the Supreme Court upheld the constitutionality of the Wagner Act, the court test of the National Labor Relations Board's cease and desist order against the Ford Motor Co. has aroused widespread interest. Involving interpretation of more phases of the act than ever before both the Government and the Ford company are prepared to carry the case to the United States Supreme Court.

As a result it is expected that provisions of the act which now are a source of confusion will be clarified. Industry has complained bitterly of —just as the Ford Co. now is challenging—the power assumed by the board to restrict the rights of employers such, for example, as the distribution of employer literature among workers to combat union propaganda whose distribution is freely permitted by the board.

Final court action it is held may not only clear up these and other powers under the act but may lead to increased demand in Congress for liberalization of the act in order to make it less one sided in behalf of organized labor. Court action will begin soon but final procedure through the Supreme Court may require considerable time.

The NLRB on Tuesday served notice that immediately after the expiration of the 10 days allowed the Ford company to notify what steps it had taken to comply with the board's order issued Dec. 22, the board will petition the United States Circuit Court of Appeals for a decree enforcing the board's order. The Ford Co. has already an-

(Turn to page 4, please)

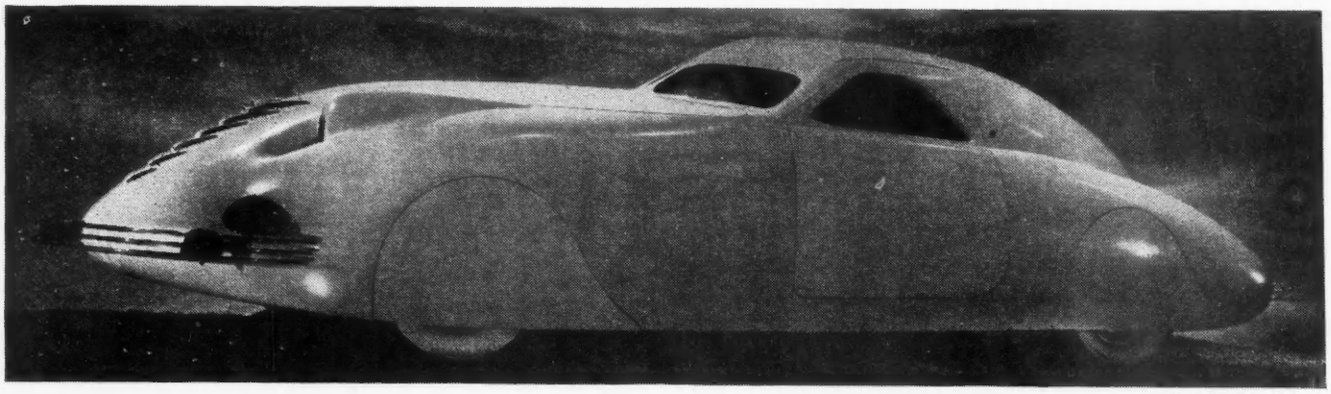


Photo by Tom Kelley

PHANTOM CORSAIR Designed and built by Rust Heinz, a young automotive engineer of Pasadena, Calif., the Phantom Corsair represents the designers' conception of the "car of tomorrow." It embodies numerous new features, is only 58 in. high, and is ultra streamlined.

There are no fenders or running boards, as the body is sufficiently wide to cover the wheels and the seat accommodates four passengers. The body is noise-insulated with cork and latex, these materials being applied in layers.

Indirect lighting is used for the interior of the body, while road illumination is effected by means of built-in headlamps of 40,000 equivalent candle power, with amber fog lights below them.

Aircraft-type alloy-steel tubing is used for the framework of the body, whose panels also are of alloy steel and are lined with a rubber composition on the inside of the passenger compartment.

Special Features of the Phantom Corsair

Among the special features of the Corsair are the following: Door handles are replaced by electric push-buttons, and the hood is raised by means of a trigger on the instrument panel. Seats are of solid molded rubber and the car has a safety feature in its "crash board," a leather-covered cushion padded with cork and sponge rubber and designed to reduce the impact in the event of a collision.

To facilitate ingress and egress, auxiliary doors are provided in the roof in line with the regular doors, which open and close automatically with the conventional doors. The auxiliary doors are said to be waterproof and rattleproof. Door hinges are concealed.

The passenger section contains two "luxury" compartments, one on each side of the rumble seat, upon which two passengers may ride, facing rear. There is an "all-wave" radio with twin speakers and an aviation-type aerial. Ceiling and side walls are lined with ¾ in. light cork composition and a layer of sponge rubber under upholstery of tufted design. The floor is treated acoustically with a layer of pulp composition, sprayed cork and rubber, and it has a floor carpet. Interior fixtures are of dull-finished chromium and unprotruding. Air conditioning equipment, which is additional, includes heat and cold-producing units that are thermostatically controlled.

Air for the engine is taken in through a system of louvers and an air scoop running the width of the front of the car. Engine fumes are carried off through dual ducts running from the engine compartment along the streamlined under side.

The hydraulic shock absorbers are adjustable from the aircraft-type instrument panel. Even the most remote instruments on the panel may be read easily. Instruments on the panel include indicators for oil temperature, oil level, oil pressure, fuel, vacuum and electric current; a battery indicator, a starter button, a tachometer, a speedometer, a clock, an odometer, a combustion-efficiency indicator, an altimeter, a compass, two cigar lighters, seven electric switches, two door-opening buttons, an extra horn button, and red lights to indicate when the radio is turned on and when headlights are bright.

All windows are of non-glare safety glass, tinted green and slanted inward toward the top to eliminate reflection. The windshield is of three-ply laminated safety glass, while the rear windows are of double-axis curved, laminated safety glass to follow the aerodynamic lines of the car.

The engine has 288 cu. in. displacement and is said to develop approximately 192 hp. Front-wheel drive is used, and there are double universal joints in each of the two driving shafts. The transmission has four forward speeds, and gear shifting is effected electrically. Top speed is said to be more than 115 m.p.h. The wheelbase is 125 in. and the gasoline tank has a capacity of 40 gal.

Mr. Heinz was educated at Choate, Andover and Yale, and studied naval architecture in New York. He recently opened a West Coast studio in Pasadena.

Recession Forces GM Lay-Off

About 30,000 Workers to be Taken from Rolls Jan. 1; "No Thought of Wage Reductions," Says Knudsen

A total of about 30,000 workers in automotive plants of General Motors Corp, are to be laid off on or about Jan. 1, due to the recession in business, W. S. Knudsen, president, announced this week. While a considerable number of men in all locations will be affected, there will still remain on the corporation's payroll in the United States more than 205,000 men, and the monthly payroll will exceed $24,000,000. Those retained will be on a 24-hour week basis, that is, three days a week.

"We have tried to keep all the men in our plants working," said Mr. Knudsen, "but business got so bad we could not continue to do this. The people who are working will have to be given hours of employment enough so that they can make a living." With wages running around 95 cents an hour, the average weekly paycheck will total $22.80.

"There is no thought of wage reductions," Mr. Knudsen asserted. Men will be laid off in order of seniority, in accordance with the corporation's agreement with the

UAW, but an effort will be made to favor men with dependents.

Announcement of the readjustment in working forces was made by Mr. Knudsen at a press conference in the General Motors Building Tuesday morning. "In bringing you here and trying to tell you the story, we wanted you to understand that we have done everything we could to keep the men at work," he told press representatives. "There isn't anything we would rather do than still keep them working, but when the stocks get so big, we have to adjust." Attending the conference, also, were general managers of several GM car divisions and other corporation executives.

Concerning the outlook, Mr. Knudsen said: "I think the present business recession is pretty well at the bottom now. We look forward to better sales in the spring. I don't see any reason why they shouldn't be there. The corporation regrets the circumstances which make this necessary, but sincerely hopes the condition will be temporary and that spring will see the return of normal employment."

He declined to predict the possibility of revision of car prices saying, "I can't tell you anything about that. So far there isn't any ground that I can see for such action." Price increases made on 1938 cars

(Turn to page 8, please)

Dryden Co. Buys Plant

Will Make Sponge Rubber Products At Keokuk, Iowa, Factory

The Dryden Rubber Co., Chicago, has purchased a plant in Keokuk, Iowa, for the exclusive manufacture of sponge rubber products, according to a recent announcement by George B. Dryden, president. The Keokuk plant will be known as the Rubber Industries Division, with U. H. Parker in charge.

Mr. Parker was associated with the Miller Rubber Co., Akron, for a number of years and was appointed manager of the sponge rubber division of that company in 1932. C. O. Frazier, formerly president of the Rubber Industries, Inc., Keokuk, Iowa, has also been retained by the Dryden organization at Keokuk.

Other recent additions to the Dryden staff include Dr. H. A. Winkelmann and R. D. Hager. Dr. Winkelmann and Mr. Hager will be associated with the Chicago organization, the former to serve in a technical consulting capacity, the latter to become production manager.

Anticipate Upswing in Tire Market

Tire Makers Seem to View '38 Outlook as Encouraging Although Original Equipment Volume May Shrink

Tire manufacturers appear to share the belief that there will be a decided upswing in the consumer tire market in 1938, although the four major companies which supply the primary market anticipate a lesser volume of original equipment business than they have had in 1937. The new year is expected to bring numerous vital developments and trends for the rubber and tire industry, such as:

1—A slowing down of the Akron industry's decentralization program and a possible return to Akron of part of the production which was transferred to subsidiary labor plants because of incessant labor trouble;

2—A probable return, early in 1938, of the eight-hour day to Akron tire plants with attendant adjustment of wages favorable to labor, a probable reemployment of many furloughed employes, and a step-up of production schedules in Akron;

3—Registering of tire prices by most manufacturers under the Fair Trade Laws of the various States. Only two manufacturers so far have registered under the California Fair Trade Law;

4—Increased consumption of crude rubber per tire, due to gradual discard of the old smaller sized tires, and an increasing production in the newer and larger sizes which take more rubber;

5—A stiffening of crude rubber prices under the reduced exportable quota for the first quarter of 1938, which very probably will avert any necessity for tire price downward revisions;

6—A complete discard of the road hazard tire guarantee and adoption by all producers and distributors of the industry's new standard lifetime tire warranty;

7—Acceleration of the trend toward accessories and the development of new rubber items other than tires and tubes, with the increased use of rubber in automobile production and in industry generally;

8—Steady increase in the use of giant pneumatic tires on farm implements, and an increasing rate of changeover from steel wheels to pneumatic-tired wheels on farm tractors now in use.

The industry has every reason to anticipate a more nearly normal market behavior in 1938 than it had in 1937. Due to rising crude rubber prices and speculative buying, seasonal trends were completely upset when consumer sales for the first quarter soared to a 53 per cent gain over the same period of 1936. Virtually all of that gain was wiped out in the balance of the year, the industry winding up 1937 with renewal sales, approximately the same as in 1936, totaling 29,800,000.

Due to heavy retrenchment in the final quarter of 1937, the industry enters 1938 in a more favorable inventory position. While production in the first nine months was 45,221,237 against 42,707,585 in the same period of 1936, third quarter output was 12,658,848 compared with 15,466,388. Fourth quarter output figures were also much lower than for 1936. Inventories were reduced from 12,528,789 on June 30 to 11,615,262 on Sept. 30 and it is believed they were reduced to not much over 10,000,000 during the final quarter. Shipments in the first nine months were 44,582,251 compared with 42,032,069 in 1936.

Output Horizon Cloudy

(Continued from page 1)

The estimated total for the industry this month looks small in comparison with January production figures for the years since new model introductions were made in the fall instead of at the first of the year. But it is only slightly under the January average of 235,000 units for the nine years preceding fall announcements. Similarly, the 1937 December production which is estimated at around 315,000 vehicles was a sharp drop from the 518,958 units built in December last year when the industry was still filling up the vacuum left by the depression years and recovery was at its height. But it was well over double the average volume enjoyed in the nine-year period before January introductions were abandoned. Even under reasonably good business conditions it cannot be expected that the production and sales of automobiles can be sustained through fall and winter months at near peak volume, such as was the experience of recent years when deferred buying from depression years was coming into the market. After all, the automobile business is still a seasonal one.

—H. E. G.

MEN OF THE INDUSTRY

ROWLAND CAMPBELL has been elected chairman of the board of the Reo Motor Car Co.

HARRY W. KALEY has been appointed general sales manager of the Ethyl Gasoline Corp. Mr. Kaley has been connected with the corporation for 11 years, serving as advertising manager and assistant sales manager.

N. A. GLANTZ has been appointed to the newly created post of field sales promotion manager of the tire division. The B. F. Goodrich Co., Akron. Formerly, Mr. Glantz had been in charge of the creation of retail advertising. E. D. NATHAN, assistant manager of tire and battery advertising will now assume these duties.

Ford-NLRB Case

(Continued from page 1)

nounced it will take the case to court and that it will not comply with the order without further litigation.

The board has announced that the 10-day period will expire at midnight Jan. 3. Hence it is expected to file its petition for a decree on the day following. The board said that if the decree is issued the company will then, if it fails to comply, be guilty of contempt. However, the company obviously will appear in court and demand argument on the petition and prepare, if necessary, to take an appeal if a decree is issued. On the other hand, in the event the decree is denied the board will appeal to the Supreme Court.

As set forth in the NLRB's statement of the case, the substance of the complaint centered on five major points: 1. That the Ford Motor Co. had disseminated propaganda disparaging to labor organizations and discouraging its employes from joining them; 2. That UAW representatives who attempted to distribute union literature at the Dearborn plant on May 26, 1937, were attacked by company representatives; 3. That the company had intimidated its employes in the exercise of their rights set forth in Section 7 of the Act; 4. That membership in the Ford Brotherhood of America, Inc., was solicited within the company's Rouge River plant with the sanction of company officials, and that the company published an announcement in the public press stating that the Brotherhood had been disbanded at its request; 5. That the company caused the "discharge, demotion, transfer, lay-off, or resignation because of membership in, affiliation with, activity in behalf of, or sympathy or suspected sympathy toward, the UAW, of certain named employes."

Upon the basis of its findings the National Labor Relations Board has ordered the Ford Motor Co. "to cease and desist from" discouraging membership of its employes in the UAW (or any other labor organization); interfering with the administration of the Ford Brotherhood of America, Inc.; and "organizing, maintaining, supporting or assisting vigilante or similar groups for the purpose of intimidating or coercing its employes" from joining the UAW or other labor group.

Further, the order forbids interference with members of the UAW distributing union literature in the vicinity of the Rouge River plant; disseminating propaganda disparaging to labor organizations among its employes; and in any other manner interfering with employes in the exercise of their rights to self-organization as set forth in Section 7 of the Act.

The company was enjoined to take the following affirmative action: Offer to the "certain named" employes immediate and full reinstatement to their former positions; To pay each of these employes the wages they would have earned since they were released, less any amount each earned in outside employment during that period; Post notices in its plants for a period of 60 days stating that the company "will cease and desist" as ordered.

[Evans' Steam-Engines. See page 196.]

ORUKTER AMPHIBOLOS

First American land vehicle to move under steam pressure, built by engineering-inventor Oliver Evans, 1755-1819, who was honored last week by the Pennsylvania Historical Society. A bronze tablet to be placed in Gimbel Brothers Department Store in Philadelphia, site of Evans' workshop 140 years ago, was presented to Ellis A. Gimbel by Edward Robins, president of the Society.

The drawing reproduced herewith is believed to be the first recorded picture of the Orukter Amphibolos. There are several amusing errors in the artist's conception: steering would be impossible with the two axles connected as shown by belt, and the steamboat application of the invention would not work out satisfactorily because the paddle-wheel shaft would be below the water line with the Orukter Amphibolos afloat.

. . . slants

LOWER HURDLES—*Reductions in the present 17½ per cent Canadian tariff on automobiles are said to be due in the near future.*

Any tariff concession to the United States in respect to cars or parts probably would be offered in exchange for a larger share of the American market for Canadian farm products, lumber, or fish. Such a move, if successful, would make cars cheaper in the Maritime Provinces

and in western Canada, where, at present, prices range considerably above those in central Canada, and it would also stimulate demand for the surplus products of the same areas.

ONE IN SIX—*Only one of every six automobiles on the highways of the United States has a market value as high as* $500, *according to a study made by the American Petroleum Industries Committee. It is estimated that these cars, constituting only* 16.1 *per cent of the total number of passenger cars in use, have an aggregate value of* $2,047,890,000, *or* 39 *per cent of the total value of all the passenger automobiles in operation.*

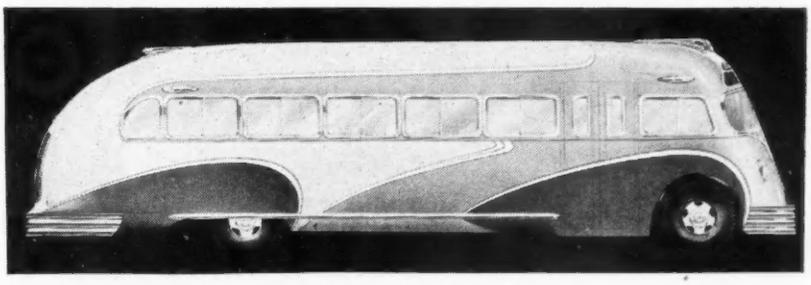
On Jan. 1, 1938, *some* 21,871,404 *passenger cars will be in operation in the United States, with a combined market value estimated at* $5,233,040,159.

TAXICAB FACTS—*A study of the taxicab industry during the year* 1937 *reveals that in the* 188 *cities of over* 50,000 *population, with a total population of* 40,000,000, *there are being operated over* 40,000 *taxicabs. This average of one cab for each* 1000 *population varies from one cab for each* 160 *population in Washington, D. C., to one cab for each* 500 *population in New York City and Boston, one for each* 800 *in Baltimore, one for each* 1000 *in Seattle, one for each* 1500 *in San Francisco, one for each* 2000 *in Philadelphia and Detroit, and as high as one to each* 3000 *in Los Angeles.*

Estimated gross income for this grouping is over $150,000,000 *per annum, with an estimated annual mileage of* 1,500,000,000 *and over* 400,000,000 *passengers annually.*

Engineering Drawings

Space limitations in this and some succeeding issues of AUTOMOTIVE INDUSTRIES preclude weekly appearance of engine drawings of Series II. Future drawings to appear in the series as space is available include the English Austin 14 hp., 6-cyl. Chevrolet (1938), Sauer (Swiss) Diesel, and several other domestic and foreign engine designs. Drawings will continue to be numbered in sequence as they appear.



HIGHWAY STREAMLINER Automotive stylist Hal Holtom restyled the model D motor coach built by Gar Wood Industries, Inc., Detroit, producing the 1938 model shown here. There are two standard types of this rear-engined unit: the suburban, seating 29 passengers; and the inter-city, seating 22 to 25.

The semi-elliptic chrome-vanadium steel springs have been made wider and longer, and are mounted on rubber. The cruising range has been stepped up from 480 to 600 miles with one filling of the gasoline tank. Positive-acting hydraulic brakes supplant the mechanical brakes used previously. The acetylene-welded, tubular-frame unit is fabricated with high-carbon, chromium-manganese 1¼-in. square steel tubing. Side and roof panels are Nicralumin.

Nine Months' Tire Sales Up 21%

Production and Sales of Tires, Tubes and Rubber Goods In Third Quarter '37 Also Show Gain Over '36

Despite a more than normal recession in production and sales of tires, tubes and rubber goods in general in the third quarter of 1937, from the second quarter, operations of the industry for the period were still far ahead of those for the same three months of 1936, with the first nine months' total of 1937 substantially ahead of the first nine months of 1936, according to official figures of the Rubber Manufacturers Association, just compiled.

The manufactured sales value of all manufactured rubber goods for the first nine months of 1937 was $659,710,000 compared with $545,020,000 in 1936 and $528,810,000 in 1935. This is a gain of more than 21 per cent for 1937 over 1936, the increase reflecting the two 6 per cent tire price increases of last January and March and the 10 per cent boost in mechanical goods and rubber sundries prices in the first quarter.

For the third quarter 179 manufacturers reported 146,408 average daily employes. This compares with 184 manufacturers reporting 130,915 employes for the third quarter of 1936 and 198 manufacturers reporting 121,753 employes for the third quarter of 1935.

While the net sales value of manufactered tires, tubes and tube sundries declined from $141,475,000 in the second quarter of 1937 to $127,640,000 in the third quarter, the third quarter figure compares with $119,353,000 for the third quarter of 1936 and $100,710,000 for 1935. The grand total of all rubber products was $215,447,000 in the third quarter, compared with $233,105,000 in the second quarter and $198,770,000 in the third quarter of 1936. Rubber products other than tires and tubes are gaining steadily as indicated by the association figures showing that in 1935 they represented only 37 per cent of the total dollar volume, and more than 40 per cent in 1937.

Reclaimed rubber consumption in the third quarter of 1937 totaled 39,000 tons against 44,700 tons in the second quarter. Crude rubber on hand at the end of the third quarter of 1937 totaled 195,715 tons against 233,000 on Sept. 30, 1936, and 331,000 tons at the end of September, 1935.

Due to its heavy inventory position, the industry retrenched drastically during the final quarter of 1937, which will reduce the year's total figures so that they will show a lesser gain over 1936 than the figures for the first nine months indicated.

Major tire plants which have been operating only two or three days per week and which have closed for inventory taking during the final week of the year, are expected to resume more aggressive schedules with the start of the new year. (See article page 3 in this issue, "Anticipate Upswing in Tire Market.") The industry ends 1937 with more than 10,500,000 tires in inventory, but dealer orders for early 1938 delivery are favorable.

The 1938 outlook is for a market for 31,000,000 replacement tires and 22,500,000 for the automobile industry with about 750,000 to be exported.

Business in Brief

Written by the Guaranty Trust Co., New York

General business activity receded further last week. The index compiled by the *Journal of Commerce* declined for the twelfth consecutive week, standing at 72.8, as compared with 74.9 for the preceding week. The chief factors in the fall in this index were a sharp reduction in coal output, and further losses in car loadings, steel production, and automobile activity. Christmas buying was in good volume. Retail trade as a whole last week was from 10 to 30 per cent above that in the preceding week and from 2 to 10 per cent above that a year ago.

The Guaranty Trust Co.'s index of business activity for November stands at 81.1, as compared with 87.3 the month before and 92.3 a year ago. The company's index of wholesale commodity prices on Dec. 15 was 67.4, as against 69.5 a month earlier and 80.6 a year earlier.

Freight Loadings

Railway freight loadings during the week ended Dec. 18 totaled 603,292 cars, which marks a decline of 18,839 cars below those in the preceding week, a fall of 126,756 cars below those a year ago, and a gain of 2626 cars above those two years ago.

Production of electricity by the electric light and power industry in the United States during the week ended Dec. 18 was 3.3 per cent below that a year ago.

Construction

Privately financed construction in November, according to the F. W. Dodge Corp., was 15 per cent below the level in the preceding month, which is somewhat more than the usual seasonal reduction. The total was 5 per cent below that in the corresponding period last year. Publicly financed construction was 20 per cent greater than in October, a rise that marks a reversal of the declining trend in this type of building activity since last July.

Lumber production during the week ended Dec. 11 stood at 44 per cent of the 1929 weekly average. Output was 4 per cent smaller than new business and 6 per cent greater than shipments.

Professor Fisher's index of wholesale commodity prices for the week ended Dec. 25 stood at 83.2, as compared with 83.9 the week before and 84.9 two weeks before.

The consolidated statement of the Federal Reserve banks for the week ended Dec. 22 showed no changes in holdings of discounted bills, Government securities, and bills bought in the open market. Money in circulation increased $85,000,000, and the monetary gold stock remained unchanged.

Nash Moves Heads

Several Executives Shifted Jan. 3 To Detroit Headquarters

On Jan. 3, 1938, heads of certain major departments of the Nash Motors Division of Nash-Kelvinator Corp. will take up headquarters in the plant of the Kelvinator Division of the corporation in Detroit. Purpose of the move, according to C. H. Bliss, vice-president and director of sale of the motors unit, is to concentrate department heads of both divisions of the corporation in Detroit.

Those who are being transferred to Detroit are:

Mr. Bliss; Courtney Johnson, general sales manager; J. E. Lamy, organization director; A. C. Tiedemann, director of business management; A. R. Boscow, director of advertising and merchandising, E. J. Reeser, sales promotion manager; Fred C. Williams, assistant advertising manager; Claus Anderson, Canadian sales manager; W. C. Engel, manager, car order department; Harold Keck, manager, statistical department; George Gieselmann, assistant service manager, and Irvin Rapp, service and accessories department.

Offices have already been established in the Detroit Nash-Kelvinator plant by Harold E. Long, former vice-president of the Nash Motors Division in charge of purchasing, but now vice-president of the corporation in charge of purchasing; Emil Clausen, purchasing agent, and Walter Stowe, buyer. O. L. Arnold, western sales manager, will continue to maintain headquarters in Kenosha.

Also moving to Detroit is the Kenosha office of Geyer, Cornell & Newell, Inc., advertising agency for Nash-Kelvinator Corp. Personnel of the office includes Karel M. Rickerson, manager; John Stoehrer, art director, and Fred L. Shaw, publicity director. This group will be headquartered in the agency's Detroit offices of the New Center Building.

New Goodyear Upholstery

A new type of bus and truck seat upholstering material, known as "Airfoam" which is made from liquid rubber latex, has been developed by the Goodyear Tire & Rubber Co., Akron.

Unlike ordinary sponge rubber, "Airfoam" is made by beating the liquid rubber latex into a froth containing millions of interconnected air cells. The "froth" is then cured in molds designed to fit the needs of truck and bus seat manufacturers. The new product is also available in mattress form suitable for sleeper cab accommodations.

Goodyear officials in announcing the new product claim it produces greater rider comfort, greater safety through decreased bodily fatigue and greater economy through elimination of repair and replacement charges. The new material will be produced on a large scale for manufacturers of bus and truck seats.

Chrysler Calls Meeting

Convention For Field Organization In Detroit On January 11

K. T. Keller, president of the Chrysler Corp., announced this week that a convention of the corporation's field organization will be held in Detroit on Jan. 11, 1938. The meeting will be attended by about 1000 persons, including regional and district sales managers, sales, parts and service representatives, and other individuals engaged in contacting distributors and dealers throughout the country in connection with the sales and servicing of the corporation's cars and trucks.

"The purpose of this meeting," Mr Keller stated, "is threefold—first, to review with the field organization general conditions, second, to discuss policies in reference to the sales of the corporation's products, and third, to discuss relations between the factory and dealers.

"It is a custom in the industry for the various companies to hold meetings with their field personnel a few months after new models have been introduced, to survey the general situation, as well as to examine the future business outlook. This will be the first time, however, that the

corporation executives have had an opportunity to consider with the entire field organization in one meeting matters relating to fundamental company policies with a view to seeing to it that company policies are thoroughly understood by all who are responsible for carrying out these policies in the field.

"The company announced some days ago that no new models or change in prices are contemplated and that subject will not be discussed. Our thought at the factory is that regularly opportunity should be afforded for the management and all of the organization in the field to check with each other on matters of policy and the meeting proposed will probably be the beginning of a series of annual discussions for this purpose."

New GM Building in England

According to *The Motor*, General Motors Corp. has decided to consolidate all its United Kingdom activities except overseas sales at Southampton, where it will establish offices and warehouses.

Subsequently, if business conditions justify, steps are likely to be taken to make substantial increases in the number of General Motors products assembled in Great Britain, to stimulate sales and to develop service facilities.

A building will be erected on land at the Southampton Railway Docks. It will include a warehouse, a parts department, a service department and a head office. General Motors imports into Great Britain Buick, Cadillac, Chevrolet, LaSalle, Oldsmobile, Opel and Pontiac cars.

40 Years Ago

with the ancestors of AUTOMOTIVE INDUSTRIES

Foreign Notes

The French regulations regarding the circulation of motor vehicles are becoming so complicated that those in charge of them have to carry around bulky volumes containing the law on the subject.

The Hon. Evelyn Ellis, who is largely interested in the Daimler Motor Co., has had constructed for his own personal use a touring carriage, specially designed for hill climbing. Its speed ranges from two to sixteen miles and it is provided with three brakes to guard against accident in descending hills.

From *The Horseless Age*, Oct. 1897.

Preliminary Facts and Figures of the Automobile Industry

for the Calendar Year 1937

From the Automobile Manufacturers Association

New Automotive Records

Total passenger car registration
Total motor truck registration
Total motor bus registration
World motor vehicle registration
Aggregate taxes paid by motor vehicle users
Gasoline consumption
Bus production

Production and Value	
Car and truck factory sales, U. S. and Canada	4,975,000
Passenger cars	4,050,000
Motor trucks	925,000
Percentage increase over 1936	8%
Wholesale value of cars, U. S. and Canada	$2,270,000,000
Wholesale value of trucks, U. S. and Canada	$ 532,000,000
Wholesale value of cars and trucks combined	$2,802,000,000
Wholesale value of parts and accessories for replacement, and service equipment	$1,075,000,000
Wholesale value of rubber tires for replacement	$300,000,000
Motor vehicle, accessories, service equipment and replacements of parts and tires	$4,177,000,000
Registration	
Motor vehicles registered in U. S.	29,650,000
Motor cars	25,400,000
Motor trucks	4,250,000
World registration of motor vehicles	42,400,000
Per cent of World's automobiles in U. S.	70%
Taxes	
Total motor vehicle user taxes	$1,580,000,000
Gasoline taxes, federal, state and municipal	960,000,000
Percentage motor user taxes to all taxes from all sources, federal, state and local	15%
Employment	
Employment, in auto, auto body & parts factories	517,000
Weekly payroll, wages	$15,500,000
Automobile's Relation to Other Business	
Automotive industry is the largest purchaser of gasoline, rubber, steel, malleable iron, mohair, lubricating oil, plate glass, nickel and lead.	
Railroad carloads of automotive freight shipped	3,725,000
Rubber used in automobile industry	75%
Steel used by automobile industry	18%
Lumber, hardwood, used by automobile industry	6%
Copper used by automobile industry	17%
Lead used by automobile industry	36%
Zinc used by automobile industry	11%
Tin used by automobile industry	14%
Aluminum used by automobile industry	12%
Nickel used by automobile industry	28%
Gasoline consumption by motor industry	89%
Gasoline used by motor vehicles (gallons)	19,500,000,000
Gasoline consumption by motor vehicles, retail value including taxes	$3,780,000,000
Lubricants used by motor vehicles (gallons)	408,000,000
Lubricants, per cent used by motor vehicles	40%
Motor Trucks and Buses	
Motor trucks in use	4,250,000
Total special motor truck taxes	$410,000,000
Fleets of more than 5 trucks, number of operators	29,750
Number of truck drivers	3,175,000
Communities served exclusively by trucks	48,500
Motor buses produced	18,000
Motor buses in use	127,000
Foreign Sales	
Number of American motor vehicles sold outside United States (U. S. exports and output in Canadian plants owned by U. S. firms)	650,000
Per cent increase over 1936	28%
Value of motor vehicles, parts and tires exported from U. S. and Canada	$392,000,000
Motor Vehicle Retail Business	
Total car and truck dealers	46,250
Total repair shops	98,529
Total retail outlets, duplications eliminated	102,342
Wholesalers	5,913
Retail gasoline outlets	380,000

Automotive Metal Markets

Accumulation of Small Lot Orders During Holiday Closure Will Permit Steel Mills to Resume with Orderly Schedules

With many of the steel mills closed down until after the New Year's holiday, a nest egg made up of small lot orders will have accumulated by the time that operations are resumed next week to permit of orderly production schedules on a curtailed week basis. With reserve stocks in consumers' hands down to negligible levels, improvement in car demand is certain to be speedily reflected in an upturn in steel commitments.

Middle West sheet mills saw some encouragement in small lot specifications for late January shipment, received this week. Makers of tool steels look for demand to manifest itself early in the new year to provide material for retooling programs that are to be spread over a larger number of months than was the case this year.

From an authoritative source came announcement this week that there would soon be in operation in this country 27 continuous sheet and wide strip mills with a combined annual capacity of more than 14,000,000 net tons. A year ago, the capacity of continuous mills then in operation and under construction was estimated at around 12,500,000 tons, so that 1937 unquestionably brought a marked increase in this modern type of rolling equipment.

The country's leading steel company executives appear to be in agreement that this development can not be looked upon as bringing in over-capacity, but that it provides production facilities, which in times of normal demand serve consumers, especially automobile manufacturers, much more promptly than was possible formerly, to say nothing of the greater uniformity of quality of the product. While an impressive number of obsolete types of mills have been permanently retired of late, there still remain available a sufficient number of them to care for the needs of consumers who require smaller lots of special numbers than can profitably be rolled by continuous mills.

The heavy investments of steel companies in continuous mills and the need of amortizing these fairly rapidly, so as to minimize the risk of obsolescence, are pointed to by steel producers as safeguards against excessive competition in the sheet and strip steel market. If automotive consumers have not benefited as much from these technical advances as they would have liked to in the cost of their flat steel requirements, they certainly have fared much better in the way of accommodation during periods of peak demand.

With London and Singapore observing Boxing Day on Monday, the tin market lacked guidance, aside from the absence of all consuming demand. An interesting piece of news comes from The Hague with reference to the possible merger of the Banka and Billiton tin companies, which amalgamation of these Dutch East Indies mining and smelting properties, together with their subsidiaries, would result in the formation of the world's largest single tin producing company and also the lowest cost producer.

The Banka company is an out-and-out government enterprise. In the Billiton and affiliated companies the Netherlands government owns a controlling interest. The Dutch parliament will have the say as to whether they shall come under absolute government control and management.

After having marked time at the beginning of the week, the tin market on Tuesday came under the influence of tax selling on the Stock Exchange, spot Straits being offered at 41¼ cents, compared with the pre-Christmas close of 42 cents.

Copper, while rather dull, ruled fairly steady, the price for electrolytic being unchanged here, but slightly off in export transactions.

White metals were quiet and unchanged.—W. C. H.

Recession Forces GM Lay-Off

(Continued from page 3)

did not cover cost increases, it was explained. The corporation had figured on the volume hanging on for 1938. Costs went up about 13½ per cent and prices, so far as GM is concerned, were raised about 8½ per cent. Volume was looked to to make up the difference. "But we evidently figured wrong," Knudsen commented.

General Motors dealers currently have on hand about 60,000 more cars than at the same time last year. These cars are spread among about 20,000 dealers. The corporation's December output will total around 140,000 units in the United States and Canada, and January should run about 90,000 units exclusive of the production of GM trucks and Canadian plants which will add about 10,000 units, making the January total around 100,000 cars and trucks.

Knudsen estimated that there were about 600,000 used cars in hands of dealers of the industry as a whole, or 150,000 to 160,000 more than a year ago. He pointed out that the stock of used cars is heavy because sales have diminished, and that sales have not diminished because stocks are heavy. But glutted used car markets were given as the principal reason for having to slow down production. He did not consider the used car situation could be traced to earlier production of new models. "It is simply a question of lack of employment," he stated. "When employment falls off, the used car business falls off." Knudsen did not consider that the introduction of a small, lower priced, economy car would help sales because of the condition of the used car market.

Giving his personal opinion of the cause of the present business recession, Knudsen stated: "I think the price level rose too fast in the spring of 1937, and we just couldn't make adjustments. The price of all commodities rose pretty fast in the beginning of 1937, and the market became weak toward midsummer. We didn't do anything ourselves until we felt the effect of high prices, and by that time purchasing power had dropped off. The products that we get from abroad I am sure were affected by a war scare. This was true particularly of rubber and tin. I think in our own case the rather rapid increase in wages might have had something to do with it."

Oldsmobile Offers New Defroster

Oldsmobile has introduced a new defroster said to be capable of delivering approximately 43 cu. ft. of warm air per minute. The unit is designed for use with Oldsmobile's 1938 center-mounted heaters and is controlled by a separate variable speed switch.

A 3¼-in. sirocco-type fan built into the defroster forces the warm air currents to the windshield through two individually mounted, flexible tubes.

Ask for Super Roads

British Group's Recommendations Follow Study in Germany

Various organizations in Great Britain interested in motor transport sent a delegation to Germany last fall to study that country's highway system. A committee appointed by the delegation is preparing a report on the observations made, which will be presented to the Minister of Transport, but in the meantime a summary of the conclusions reached by the delegates has been given to the press by the interested organizations. These conclusions, in part, are as follows:

1. Development of existing through roads is hampered by the necessity for acquiring extremely expensive property.

2. An easier and safer flow of traffic would be more likely to be attained by the construction of some new roads in virgin country.

3. On the basis of relieving traffic congestion and from considerations of economy, the provision of special motor roads in conjunction with the present system is necessary in certain cases.

4. To relieve the pressure on adjacent roads in the existing system and thereby increase safety, such special motor roads should be designed to carry through traffic and be made available for sectional traffic, where necessary, by means of entrances or exits at intervals of 5 to 10 miles.

5. Early action, on a comprehensive scale, should be taken to embody, whenever possible, in existing highways, the safety precautions apparent on the German Autobahnen.

6. Judging from results obtained in Germany, new highways with twin carriage ways can be built to blend with the landscape without offending amenities.

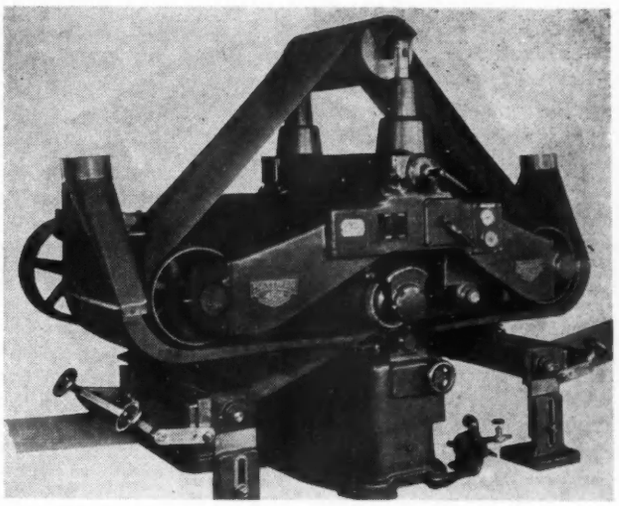
7. The needs of industrial and private traffic and the advantages of such roads from a strategic standpoint are factors which cannot be ignored.

Humber, Ltd., Extends Holdings

At a recent meeting of Humber, Ltd., England, Col. J. A. Cole, chairman, announced that Humber, Ltd.—which is one of the Rootes group of companies—had acquired the whole of the share capital of Clement-Talbot, Ltd., and of Sunbeam Motors, Ltd.

Humber, Ltd., is developing a research department, and the companies absorbed will have the full benefit of its research activities.

TOOLS OF TOMORROW



Mattison's new strip grinder offered in 12, 18, 24, and 36-in. sizes.

Strip Grinder

. . . Mattison offers new equipment in 12, 18, 24, and 36 in. sizes.

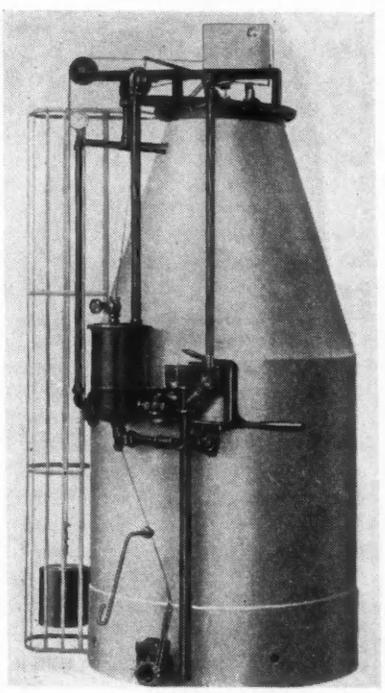
A new machine for grinding strip coil by means of factory coated abrasive belts has been produced by the Mattison Machine Works, Rockford, Ill.

Designated as No. 464, the continuous strip grinder has power driven reels at each end from which the strip passes guiding rolls and moves over the work support roll. The work support roll is air actuated with quick movement for disengaging work from the belt.

The grinding roll is cushioned and has adjustable grinding tension. It is possible to operate the belt in either direction, according to the direction in which the strip is traveling.

Flexing of the strip as it passes over the support roll and the point of contact of the grinding roll provide for fast-cutting belt action, and the action of the wide belt grinders on wide sheets is said to be duplicated.

The machine is made in widths for grinding 12, 18, 24 and 36 in. wide strip.



Air Reduction Sales Co.'s latest acetylene generator

Acetylene Generators

. . . Two new double-rated units with 300 lb. and 500 lb. carbide capacities.

Two double-rated stationary acetylene generators have been added to the line of equipment manufactured by the Air Reduction Sales Co., New York, N. Y. The new generators are available in both 300 lb. and 500 lb. carbide capacities and have rated delivery capacities of 600 cu. ft. and 1000 cu. ft. of acetylene per hour, respectively.

The 300 lb. generator shell is 42¾ in. in diameter and 105 in. high, while the 500 lb. shell is 54¾ in. in diameter and 115 in. high. Shells of both generators are of heavy gage sheet steel hot galvanized inside and out to give high protection against corrosion.

AUTOMOTIVE ABSTRACTS

Ackermann Steering Gear

The Ackermann steering gear, which today is being used on nearly all automobiles, was invented more than 100 years ago, but it was not adopted for any of the steam road vehicles developed during the period immediately following (1820-1840). The predecessor of the Ackermann or pivoted-knuckle steering gear was the swiveling fore-carriage, or fifth-wheel system of steering. Even this was not known to the Romans, and O. F. Dendy Marshall in an article in *The Engineer* suggests that that was one of the principal reasons they built their roads so straight.

Mr. Marshall considers the Ackermann steering gear one of three great inventions that made the present automobile possible, the other two being the gasoline engine and the pneumatic tire. He thinks the steering gear should be ranked even ahead of the gasoline engine, for if Daimler had never lived we would undoubtedly have excellent steam automobiles today. Without the conventional gear of today it would be necessary to use the swiveling fore-carriage, and this would limit safe speeds to about 20 m.p.h.

The divided-axle steering gear was not invented by Ackermann but by Rudolph Lankensperger, a carriage builder of Munich, Germany. Ackermann acted as Lankensperger's agent in procuring a British patent, which was issued in 1818. Lankensperger applied the divided-axle steering gear to a number of carriages, one of which was built for the king of Bavaria. An essential feature of correct steering is that the axes of all of the road wheels shall always meet in a common point, the vertical line through which is the axis about which the vehicle turns. To meet this requirement it is necessary that the knuckle arms should not be at right angles to the spindle axis but make an oblique angle therewith, and the drawing which accompanied the patent specifications shows that this condition is met; for although the root of the knuckle arm is at right angles to the spindle axis, the arm is curved.

Among the advantages claimed for the steering gear in the patent application are that as the wheels do not have to turn under anything (as they would with a swiveling steering axle) they can be made larger; that the vehicle will not upset so easily, and that it is easier to get out of ruts. Some years after the patent had been issued in England, Ackermann (who was a publisher) published a pamphlet on the subject, in which he made the statement that some 30 carriages had been built with this steering mechanism. However, he complained bitterly of the aversion with which British carriage builders of the period regarded it. It was only when development of the gasoline automobile was taken in hand in the eighteen-hundred nineties that this steering gear was widely adopted.—*The Engineer*, Dec. 3.

Tachometers

There are three types of tachometers in practical use at present: the centrifugal, the magnetic drag, and the electric types. Advantages of the centrifugal type are that the force acting on the moving system increases as the square of the speed, which permits of high accuracy at high speeds (0.2 per cent of the maximum scale reading), and that its indications are independent of temperature, magnetic fields, and air pressure. Owing to the fact that the deflections of the moving system are proportional to the square of speed, the scale range is usually limited to 1:10. Various centrifugal systems are being used, referred to as the cross type and the ring type. As a damping means on the swinging masses, use is made of fans driven from the indicating mechanism. The pointer is not aperiodic but requires only from one to two seconds to come to rest.

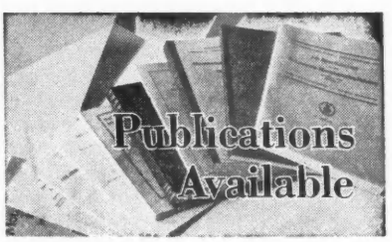
In magnetic-drag indicators the force on the movable system increases in direct proportion to the speed, but it is quite small, and the movable system therefore must be mounted freely (in jewelled bearings). The scale begins at zero and is uniform, but indications are strongly influenced by the temperature (0.22 per cent per deg. Fahr.). To compensate for temperature effects, a temperature-sensitive magnetic shunt is placed across the poles of the magnet, or the air gap between the magnet poles and the return circuit is varied by means of a bimetallic thermostat.

In a well-designed tachometer of this type an accuracy of ± 0.2 per cent of the maximum scale reading can be obtained, over a temperature range of ± 18 deg. Fahr. In larger tachometers of this type the magnet usually surrounds the armature drum, while in smaller ones it is placed inside the drum. No special damping means are required.

Magnetic-drag speedometers are used as speedometers on automobiles almost to the exclusion of other types, having taken the place of the centrifugal type, on account of their lower cost of production. This type is being used also on small sport planes and is coming into more extensive use as a cutting-speed meter on machine tools.

Electric tachometers are of the remote-reading type and comprise a generator (which is generally of the magneto type) and a voltmeter. The generator may be either of the alternating or direct-current type. With direct currents a movable-coil type of meter is used, while with an alternating-current generator it is customary to use either a rotary-coil meter in conjunction with a dry-type rectifier, or else an electro-dynamic meter. With the direct-current generator the direction of rotation has an influence on the indications. This can be avoided by using an alternating current generator.

Tachometers of the type which indicate the average speed of revolution for a certain period are also discussed in the article under review.—*V.D.I.* Nov. 27.



Red Ring **lapping compounds** are described in a pamphlet recently issued by the National Broach & Machine Co., Detroit, Mich.*

A new type **automatic rivet setter** manufactured by the Chicago Rivet & Machine Co., Chicago, is described in a circular just published by that company.*

The Telebrineller, a **portable Brinell instrument,** is described in a circular recently brought out by its manufacturer, Teleweld, Inc., Chicago.*

The Bellevue Industrial Furnace Co., Detroit, has prepared a catalog, No. 6, which lists and illustrates various sizes of brass and aluminum melting and crucible **heating furnaces.***

"How to Change Over to **Welded Design** for Profits" is the title of a new 32-page

bulletin issued by The Lincoln Electric Co., Cleveland.*

Laboratory equipment such as pebble, ball and tube mills, mixers, kettles, autoclaves, filter presses, etc., are described in the latest catalog brought out by The Patterson Foundry & Machine Co., East Liverpool, Ohio.*

* Obtainable from editorial department, AUTOMOTIVE INDUSTRIES. Address Chestnut and 56th Sts., Philadelphia.

NADA Postpones Annual Session

Postponement of the annual meeting of the National Automobile Dealers Association, originally scheduled for the week of Jan. 16, 1938, was announced this week by A. N. Benson, general manager.

According to Mr. Benson, the decision to postpone the session was made by the Executive Committee in view of important changes in the offing, and also because of the fact that many of the activities in which the Association is now engaging cannot be culminated in less than 60 to 90 days.

These activities relate mainly to the investigation of manufacturer-dealer relations through the Federal Trade Commission as proposed in H. J. Resolution 389, which is now in committee, and the proposed Fair Trade Conference for the adoption of rules to govern the industry.

Hercules Adds to Line

Offers Two New Gasoline Engines Of Two-Cylinder, L-Head Type

Two models of two-cylinder, heavy-duty gasoline engines and power units have been added to the engine line manufactured by the Hercules Motors Corp., Canton, Ohio. Designated as models NXA and NXB, the former has bore and stroke dimensions of 3 in. by 4 in., making the displacement 56.5 cu. in. Bore and stroke of the NXB are 3¼ in. by 4 in., making the displacement 66.3 cu. in.

The two engines are identical in general design and the majority of the parts are interchangeable, the only difference being in the bore size and the parts affected thereby. Maximum torque of the NXA is 39 lb-ft. at 1100 r.p.m., that of the NXB, 46 lb-ft. at the same speed. For continuous peak load service both models can be operated up to 1800 r.p.m., at which speed the NXA develops 12.4 corrected hp. and the NXB 14.7.

The crankcase is cast integral with the cylinder block, and carries the crankshaft supported by two main bearings. These bearings are 2 in. in diameter; the front bearing is 1 9/16 in. long and the rear bearing 1⅝ in. long. Connecting rod bearings are 1¾ in. in diameter and 1⅛ in. long. Center to center length of connecting rods is 6 9/16 in.

Cast iron pistons carry three rings above the pin, two compression and one oil. The former are ⅛ in. in width, the latter is 3/16 in. in width. Piston pins are of 1020 SAE McQuaid Ehn tested steel ¾ in. in diameter. Aluminum pistons can also be supplied.

These engines have L-head cylinders and the valves have 30 deg. seats. Exhaust valve clear diameter is 1⅛ in., and that of the intake valve, 1¼ in. In the NX series, the crankshaft is counterbalanced to compensate for the full amount of the rotating mass, plus 45 per cent of the reciprocating mass.

Provision is made for the usual accessories, including generator, starter, flange-mounted magneto, battery-type distributor, mechanical governor, fuel pump, fan drive, and 1-in. carburetor.

Thomas S. Merrill

Thomas S. Merrill, secretary of the General Motors Corp., died last week after a brief siege of pneumonia. Mr. Merrill, who was 59 at death, joined the corporation in 1909 and had filled the position of secretary for the past 21 years.

Calendar of Coming Events

Foreign Shows

Peru, Automobile Show, Lima, Dec. 23-Jan. 6, 1938

Leipzig, Trade Fair, March 6 to 14, 1938

Conventions and Meetings

American Engineering Council, Annual Meeting, Washington, D. C. .....Jan. 13-15, 1938

SAE Annual Meeting, Detroit, Jan. 10-14, 1938

American Road Builders' Association, Cleveland, Jan. 17-21, 1938

American Society for Testing Materials, Spring Regional Meeting, Rochester, N. Y. March 7, 1938

SAE National Aeronautic Meeting, Washington, D. C. March 10-11, 1938

SAE National Passenger Car Meeting, Detroit, March 28-30, 1938

Books

of automotive interest

STATISTICAL CLASSIFICATION OF DOMESTIC COMMODITIES EXPORTED FROM THE UNITED STATES, *Schedule B, revised edition.*

All exporters of automotive products, in order to avoid difficulty in clearing their shipments to foreign countries after Jan. 1, 1938, are advised to secure a copy of this publication. Exporters are required to furnish the detailed commodity descriptions which appear in Schedule B in their export declarations submitted to the Collectors of Customs, and documents which have not been properly prepared in accordance with this schedule will not be accepted.

While exporters are not required to insert on declarations the statistical code numbers of the Department of Commerce shown in Schedule B, the use of these code numbers is recommended as it facilitates the work of clearing shipments and the compiling of statistics. Further, the use of the commodity code numbers in addition to the commodity description aids in the work of proper classification and, hence, improves the accuracy and utility of the figures. The Department of Commerce urges that these classification numbers also be inserted by exporters.

Copies of Schedule B may be secured for the price of 30 cents each from the Superintendent of Documents, Washington, D. C., and district offices, Dept. of Commerce.

New Personnel in Hudson Sales

Promotions and increases in the sales department of the Hudson Motor Car Co. have been announced by William R. Tracy, vice-president in charge of sales.

William A. Baker has been named manager of the national used car department, and C. W. Treadwell, manager of the business car department. Both Mr. Baker and Mr. Treadwell will be located at the factory in the sales development department which is headed by M. M. Roberts.

In addition to these appointments, six regional sales development appointees have been named. These are: northeast, J. K. Shaw; southeast, D. R. Slaughter; central, O. W. Teeple; midwest, Curt Collins; southwest, G. A. McManus; and Pacific, F. D. Cox.

A corner of the engine machine shop with perspective of part of the cylinder head line. Equipment at the left is group of Moline Hole Hogs.

Varying

By JOSEPH GESCHELIN

ONE of the best examples of the fundamental differences between mass production and job-lot production came to our attention during a recent visit to the Buda Company, engine builders at Harvey, Ill. Here is an operation featuring unusual variability of product design and specification options, with applications extending into all the familiar mechanized fields — motor trucks, buses, industrial equipment of every kind, tractors, marine units, small railcar units, etc.

Perhaps the most striking attribute of Buda's manufacturing setup is the skillful handling of the problem of product variations by three management devices:

1. Flexibility of machine lines by adoption of flexible, unit-type and universal machine tools.

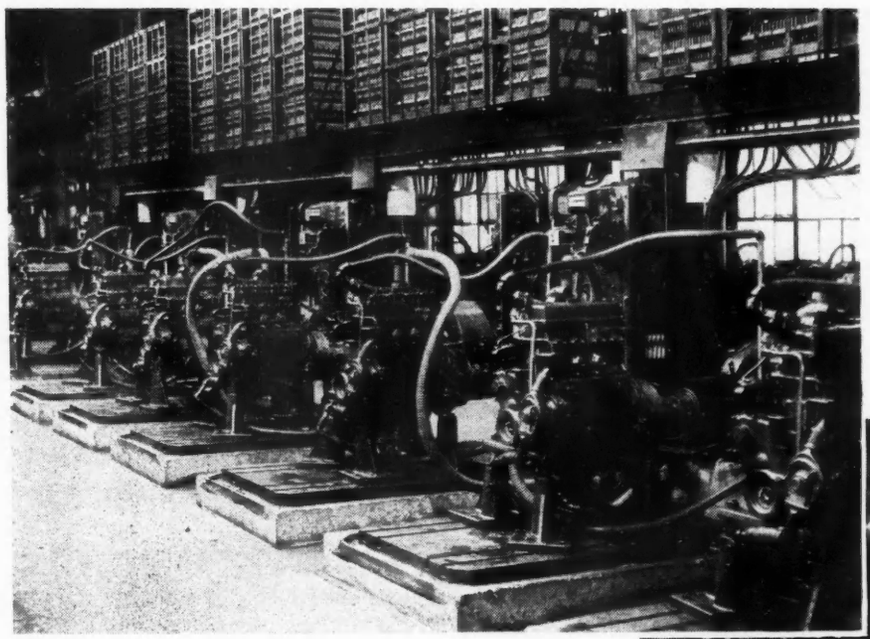
2. Universality of tool set-ups through the development of unique jigs and fixtures capable of rapid but precise adjustment to accommodate an entire family of similar parts.

3. Coordination of equipment and tooling to provide precise quality control at most favorable cost with job lot production.

Let it be noted that they are doing a very successful job of producing work within extremely close tolerances, particularly on Diesel engines —and turning it out at costs that compare favorably with more specialized operations.

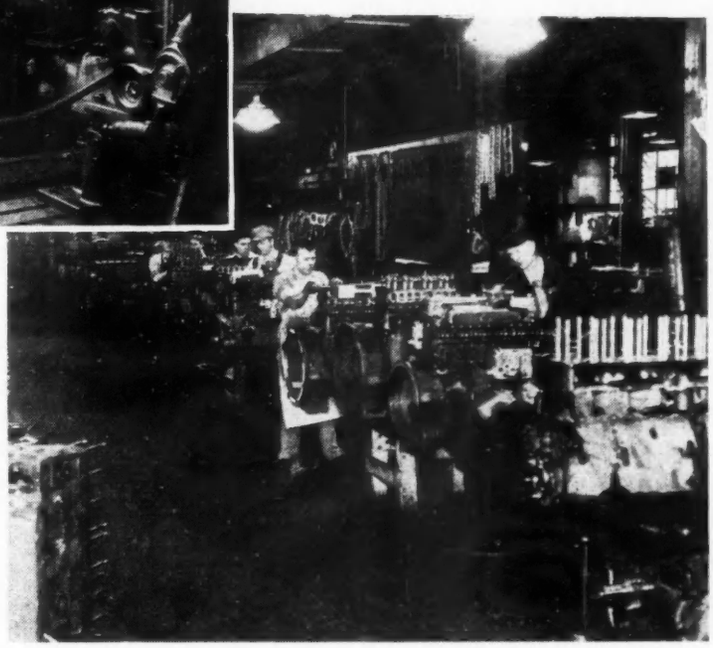
The Buda company was established in 1881 at Buda, Ill., moving to Harvey in 1891. In its beginnings, the principal products were items of railway equipment and supplies which required very little machining. Later the lines were expanded to include many sizes and styles of hand cars, push cars, motor cars, inspection cars, etc.

The year 1910 marked the birth of Buda internal combustion engine



(Left) General view of one side of battery of new double-end dynamometer stands recently installed for the testing of Diesel engines.

(Below) Looking down the motor assembly. View showing assembly of the small four-cylinder Diesel engine.



manufacture, primarily for motor trucks. Some time later this activity was expanded into the then growing field of taxicabs and buses, eventually reaching out into the industrial applications for shovels, compressors, etc.

The first Buda Diesel engines, of

Product Design at Buda

has developed flexibility of machine lines—universality of tool set-ups—and coordination of tooling and equipment to a high degree of efficiency

THIS IS THE TWENTY-FIRST IN THE SERIES OF MONTHLY PRODUCTION FEATURES

Factory Executive Personnel

F. E. Place	Vice-president and general manager
E. D. Conant	Vice-president in charge of manufacturing
D. C. Fee	Manufacturing engineer
L. Zeephat	Shop superintendent—engine division
J. E. Durfee	Maintenance superintendent
H. J. Dill	Planning superintendent
F. Adams	Chief inspector
C. Lomax	General foreman—assembly and test
J. McFarland	General foreman—large Diesel division
C. Ledell	General foreman—railroad division
C. T. Miller	General foreman—frog and switch division
J. D. Wiseman	Foundry superintendent

for trucks, buses, tractors, and industrial use were first introduced in 1930.

Currently Buda builds 55 different engines, comprising the following specific classifications:

Gasoline engines, 27 models, for automotive and industrial use.

Diesel engines, 11 models, for automotive and industrial use.

Diesel marine engines, 8 models.

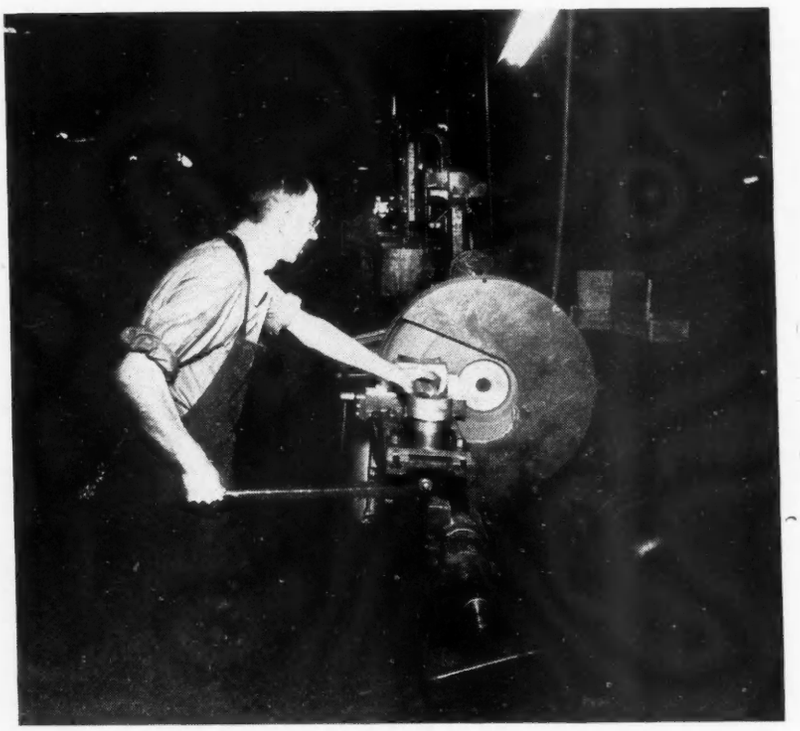
Gasoline marine engines, 9 models.

In the production of automotive gasoline and Diesel engines the company utilizes 351,155 sq. ft. of operating space, allocated as follows:

Gas and Diesel manufacture and assembly	186,174 sq. ft.
Railroad equipment	85,594
Pattern and wood shop	7,680
Foundry	53,751
Office and engineering	15,520
Experimental laboratory	2,436

stationary type, for industrial equipment, marine service, generator sets, and power units of every description were placed on the market in 1926. By 1933 Buda had embarked on the development and production of the automotive, high-speed type Diesel for trucks, buses, and other applications.

Buda "Hivelo" gasoline engines, the forerunners of the current line



Close-up of Gardner face grinder used for grinding parting line of rods and caps using precision bearings. Feature of set-up is universal work-holding fixture that can accommodate every rod of this type, regardless of size.

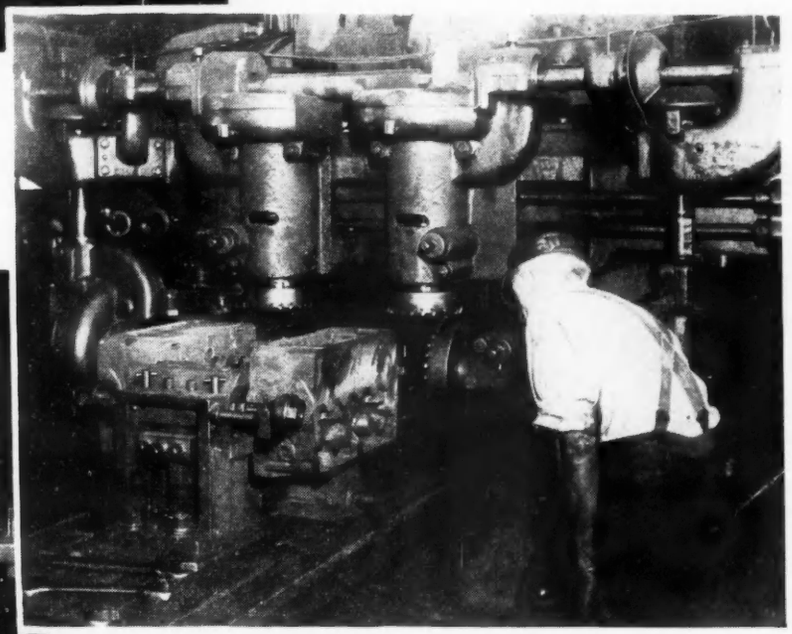
(Left) Drilling Diesel cylinder head stud holes on Natco multiple spindle drill.

It takes but a cursory look behind the scenes to realize that the complication of scheduling a line of 55 engines does not begin to cover the entire problem. Every engine in the line is virtually custom-built to the user's specifications. Inquiry discloses a large variety of cylinder blocks, oil pans, heads, and flywheels. In fact, of the latter alone, they have in current production over 2000 different specification options.

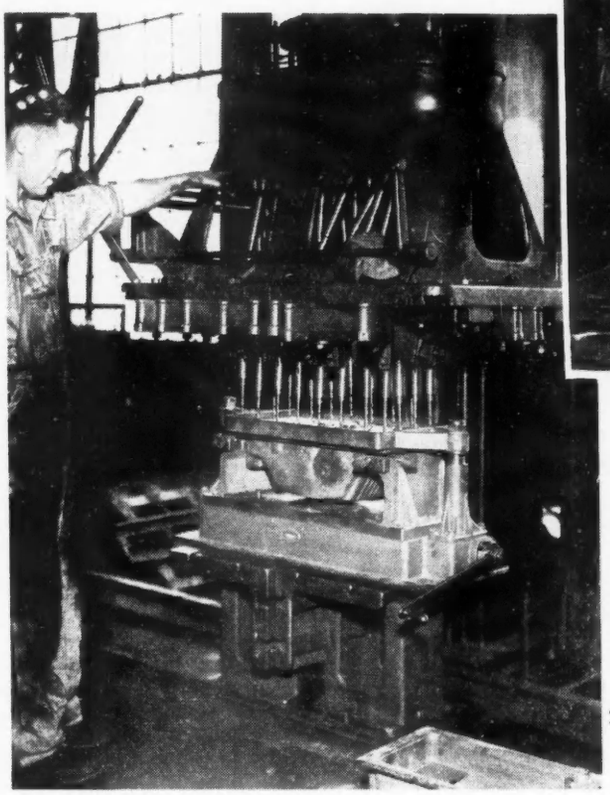
Battery of two new 18-in. automatic Cincinnati mills in general machine shop. These mills handle a wide variety of milling operations.

simply, the goal of modern job lot manufacture is the development of routing and scheduling capable of handling the flow of options smoothly, at requisite quality levels, at competitive cost.

What impressed us most was the evidence of the thought and skill leveled at the layout of machine lines and fixtures to permit the routing of many similar parts over the same lines. These functions are exemplified in the production of major ele-



Huge Ingersoll milling machine is set up for rough and finish grinding cylinder heads.



(Left) Drilling oil pan holes on Natco drill

Flexibility of process and universality of equipment loom large as the key to the ability of the factory management to handle the seemingly endless variety of product with expedition and at reasonable cost levels. Herein lies the typical setting of the production problems of the vast number of manufacturers in the wide front of the automotive industry in all its ramifications. Stated

Productive Departments

Foundry
- Cupola
- Molding
- Coremaking
- Mill room

Large Diesel
- Diesel machine
- Diesel assembly

Engine (Gas and Diesel) Machining Depts.
- Manifold, flywheel and bearing cap

Engine (Gas and Diesel) Machining Depts.—cont'd
- Cylinder-head machining and assembly
- Third floor—small parts
- Second floor—large parts
- First floor—cylinder block
- Connecting rod

Assembly Departments
- Engine assembly
- Engine test
- Power plant assembly
- Engine trim and ship

Factory Routing— Diesel Cylinder Block

OPERATION	EQUIPMENT
Rough and finish mill top and bottom, mill valve cover contact	Ingersoll mill
Drill and ream 2 locating holes	American radial drill
Rough and finish mill bearing cap fits, mill water jacket cover contact	Special Ingersoll mill
Straddle mill main bearing faces	Special Ingersoll mill
Mill both ends	Ingersoll mill
Drill main oil lines	Double end Rockford horizontal drill
Rough and semi-finish bore cylinder barrels	Six-spindle Moline Hole Hog
Face off locating bosses, drill, tap and drive pipe plugs	American radial drill
Drill air relief hole for water test	Electric hand drill
Water test	Special Universal water testing machine
Counterbore top of cylinder barrels	Cincinnati vertical drill
Rough bore cam bore	Rockford horizontal drill
Mill pads both sides of case	Plain Cincinnati mill
Drill all holes both ends	Natco horizontal double-end multiple drill
Drill all holes, both sides	Natco horizontal double-end multiple drill
Drill all holes top and bottom	Natco horizontal double-end multiple drill
Drill (7) angular oil holes from main oil hole to crank main bearings	Moline Hole Hog
Drill 2 oil lines crank to cam	Moline Hole Hog
Drill oil relief and hole for ½ in. tap	American radial drill
Drill angular oil hole	American radial drill
Drill 2 water holes	American radial drill
Drill 6 oil holes in side	American radial drill
Counterbore 4 locating holes for valve lifter bracket	Colburn vertical drill
Counterbore at end of camshaft	24 in. Cincinnati drill
Drill angle hole for oil gauge	Avey special single spindle drill
Tap all holes in bottom	Hammond radial tapper
Tap sides and ends	Hammond radial tapper
Drill and ream and tap deep oil holes	Hammond radial tapper
Rough bore crank and cam holes	Rockford special boring machine
Finish bore crank and cam holes	Rockford special boring machine
Counterbore for oil pump	Rockford horizontal boring machine
Drill and ream and tap one end	American radial
Finish line ream crank bores	Special air machine
Finish line ream cam shaft bearings for precision bushings	Special air machine
Press in cam bushing	
Drill and ream and tap other end	American radial
Drill for name plate	Hercules air drill on special stand
Finish bore cylinders	Foote-Burt vertical drill
Hone cylinder barrels	Moline honing machine
Wash	
Press liners in cylinder barrels	
Inspect	

ments such as — cylinder blocks, heads, oil pans, flywheels, and connecting rods. The universal fixtures, of which a number of examples will be described later, naturally are higher in first cost than fixtures intended for a single part, yet most economical in first cost when we consider that they are used for an entire family of parts.

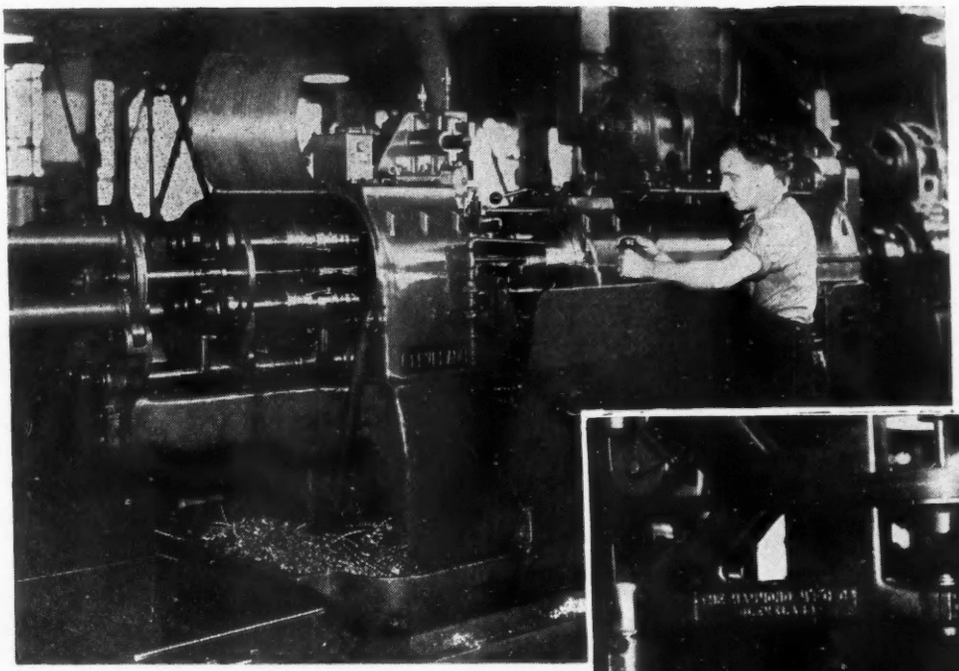
Part of the story behind the ability to provide this unique picture of flexibility may be attributed to a conscious division of manufacturing functions. Only the current Hivelo gasoline engine line and automotive Diesel are routed over the chief machine and assembly lines. The big stationary Diesels are erected in a separate department and most machining operations are handled on special equipment. The same is true of the line of older gasoline engines being built for special industrial service.

Very Close Limits

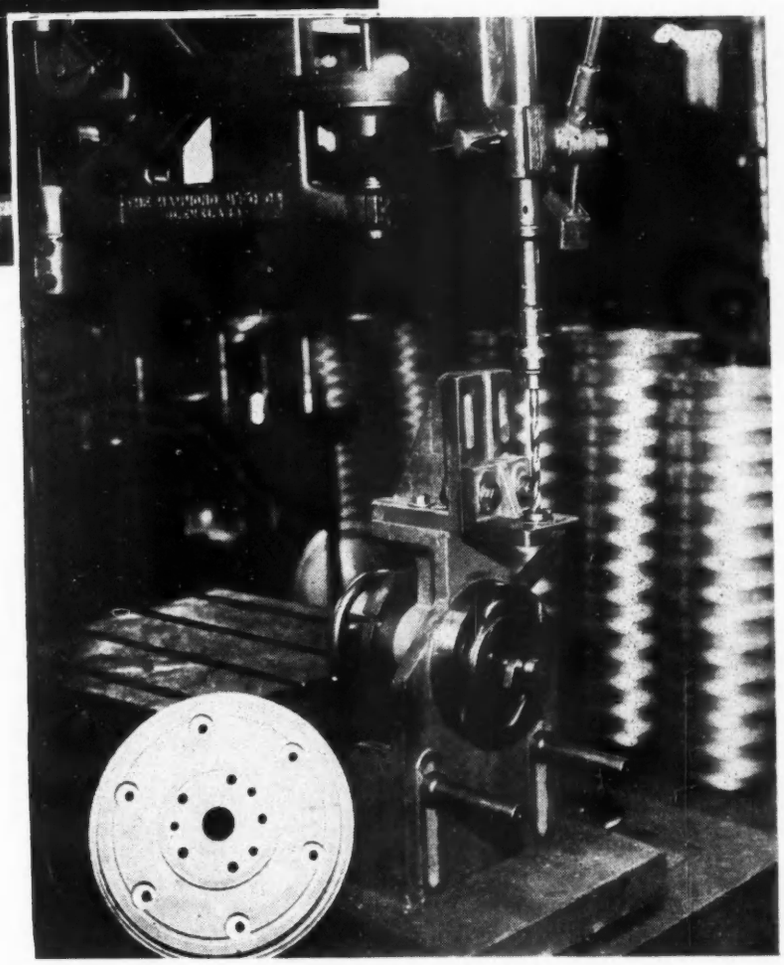
Very close manufacturing limits are required in the production of Buda automotive Diesels. Several examples will be given later. In general, quality control is an important function in this operation. This originates with the initial tool setting on each job and each machine and is followed closely by the inspector assigned to each burden center.

Painstaking attention to the smaller details, which after all control the success of the operation, is an obviously important activity. Buda takes pride in being one of the earliest users of Stellite tipped tools. Today, every milling cutter over 2½ in. diameter used for roughing and finishing operations on cast iron has inserted blades tipped with J-metal. Another primary operation, specially tooled, is that of semi- and finish-boring cam and crank bores. For this purpose they have purchased a number of individual sets of Davis boring bars fitted with fly-cutters tipped with Carboloy. A fundamental feature of these Davis boring bars is the provision of micrometer screw adjustment for each fly-cutter, enabling the tool setter to adjust the bar in increments of 0.0001 in. for any desired diameter.

One of the major items of expenditure in the current modernization program was the expansion of the final block testing department. The new equipment includes a battery of 15 double-end electric cradle-type dynamometers to accommodate a very gratifying increase in Buda's



(Below) Here is a close-up of the unique drilling fixture designed for drilling peripheral holes in flywheels. The universal indexing head is located in the rear. This is an excellent example of Buda's universal fixture design, being capable of adjustment for the entire variety of some 2000 variations in flywheel specifications.



Close-up of huge Cleveland four-spindle, Model K, automatic which is part of a battery of new machines in the screw machine department.

automotive Diesel engine business, particularly in an accelerated adoption of the new four-cylinder Diesel for tractors and industrial units. The block testing department now comprises some 44 dynamometer stands as well as two inclined beds for testing marine engines under actual water level conditions.

After the engines have run the gantlet of the block test, they are moved to another section of this department where they are spray-painted according to standard specifications on a unique overhead, merry-go-round conveyor line that traverses the spray booth.

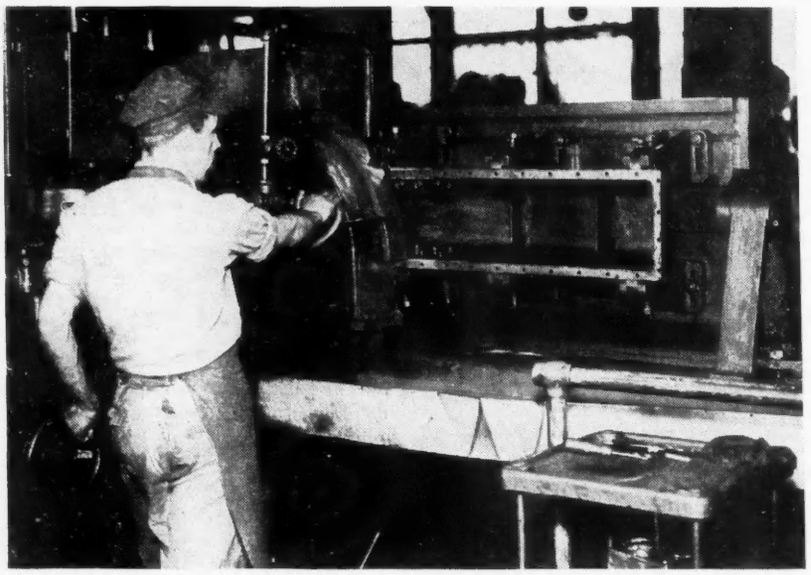
Industrial power plant units intended for the gamut of applications in every field, are erected on a special floor conveyor line in the main shipping department. It's a job for specialists rather than assembly line operators in the general sense of the word, since every unit is custom built. The standard units such as engine, power plant details, base, etc., are routed to the assembly lines. From this point on each unit is a special problem which has to be built up from specifications. In addition to fitting the engine with special accessories of every kind, the skilled man in this department also is charged with the responsibility of forming and fitting the special metal shrouds and exterior styling to suit the customer's requirements. Here is the sphere of the all-around craftsman at his best.

So far we have tried to create a generalized perspective of the work of this organization—together with its many special problems. Succeeding sections of this discussion will deal briefly but specifically with each of the major elements of the engine line—cylinder blocks, heads, oil pans, and connecting rods.

Typical factory routing forms for each of these items are reproduced elsewhere in this article, in tabular form, so as to give the production man a good picture of how the job is done. For the rest, we present a complete pictorial section comprising views in every corner of the plant, so selected as to give a better mental picture of the entire operation.

Main Machine Floor

The first floor machine shop is concerned principally with the machining of cylinder blocks, flywheels, connecting rods, and certain miscellaneous castings such as manifolds, for example.



two Natco model C8H hydraulic units and a fixture pedestal upon which is mounted a single stationary universal fixture with interchangeable bushing plates arranged to hold one cylinder block. Each unit has an adjustable joint drive head, size 18 in. x 48 in., bored for 42 and arranged with 42 1½-in. joint drives. Furnished with this machine are three sets of slip-type spindle plates and the necessary slip-type spindles.

Entire line of cases, heads, and other castings may be ground on this big Diamond grinding machine. It replaces milling operations on parts cast in chrome-nickel alloy irons.

Overshadowing all other operations is the extremely flexible machine line for cylinder blocks. It is so tooled as to handle the entire Hivelo line of five primary models; and the automotive diesel line comprising four primary models. In all, 22 different blocks go over the line. Obviously, with this complexity of product variation, it is impossible to go beyond a certain degree of interchangeability of machine or fixture features. For this reason, the blocks are scheduled in groups of minimum lots for each type. The entire line is adjusted for a single run of a given lot; then re-adjusted for each succeeding lot.

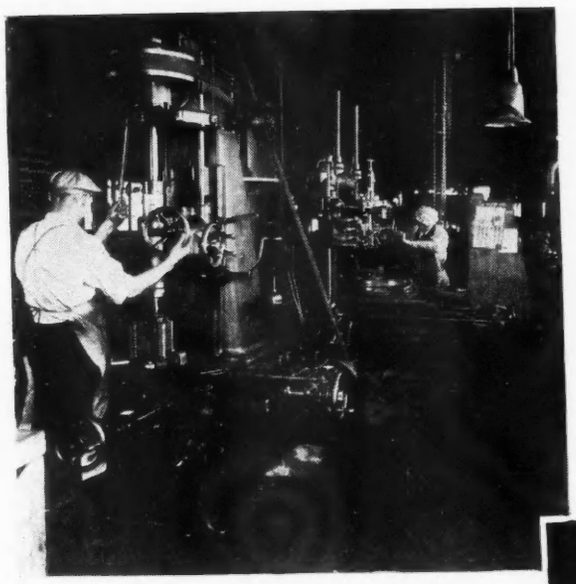
By using universal fixture capable of quick adjustment for any part and by using unit-type or universal types of machines, it is possible to make a change-over quickly and at reasonable cost.

At the moment, the most outstanding piece of equipment on the line is a huge two-way machine featuring a novel application of Natco drilling heads mounted horizontally and fitted with adjustable, joint-driven slip spindles. Each head contains the full complement of joint drives for the entire range of spindle spacing and number of holes required for the full variety of cylinder blocks. However, due to the complexity of such combinations, it was found desirable to provide the machine with three different slip spindle cluster plates which are readily installed as required. Between the three cluster plates, there are sufficient combinations to handle all the work going over this line.

In detail, this machine comprises

Factory Routing—Diesel Cylinder Head

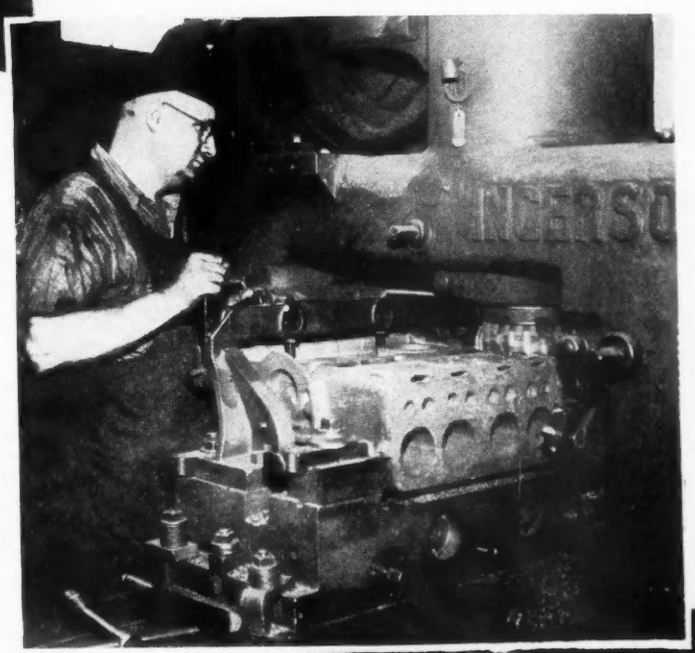
OPERATION	EQUIPMENT
Normalize	Foundry checking fixture for rough cylinder-head
Mill top and 1 side (2 at a time)	Ingersoll mill
Rough and finish mill bottom	Ingersoll rotary mill
Drill stud holes	Natco multiple - spindle drill
Ream 2 locating holes	American radial drill
Core drill valve throats	Moline Hole Hog, 12 spindle
Drill valve guide holes	Moline Hole Hog, 12 spindle
Counterbore valve spring seats	Moline Hole Hog, 12 spindle
Drill push rod holes	Moline Hole Hog, 12 spindle
Drill nozzle holes	Moline Hole Hog, 12 spindle
Drill air chamber holes	Moline Hole Hog, 12 spindle
Ream valve guide holes	Moline Hole Hog, 12 spindle
Rough form ream combustion chambers	Moline Hole Hog, 12 spindle
Drill, rough, semi-finish and finish ream air chamber	American Hole Wizard
Drill, rough, semi-finish and finish ream nozzle holes	American Hole Wizard
Finish form combustion chamber	American Hole Wizard
Mill passage and radius between combustion chambers	No. 5-C vertical Becker milling machine
Drill, tap and counterbore top complete	American radial drill
Drill and tap holes for nozzle clamps and air chamber retaining plugs, also manifold stud holes and pipe tap hole	American radial drill
Spotface locating lugs and spotface water inlet pad	American radial drill
Drill and tap for 1 in. pipe tap each end	American radial drill
Water test	Special fixture
Drill water circulating holes (13) ⅜ in. holes, counterbore holes for dowel bushings	Cincinnati single-spindle drill
Burr all over	
Ream, counterbore and assemble valve guides and valve seat inserts. Grind valve seats and wash	24 in. Cincinnati-Bickford single-spindle drill



(Left) View in general tool room with new Pratt & Whitney precision jig borer in foreground; Société Genevoise (Swiss) precision jig borer in background.

One set of plates is arranged for the drilling of five different blocks (cover side and valve side). The plate for the cover side has a total of 66 drilling centers. However, the number of holes drilled in any one block varies from 47 to 56. The plate for the valve side has a total of 68 drilling centers, but the number of holes drilled in any one block varies from 16 to 32 holes.

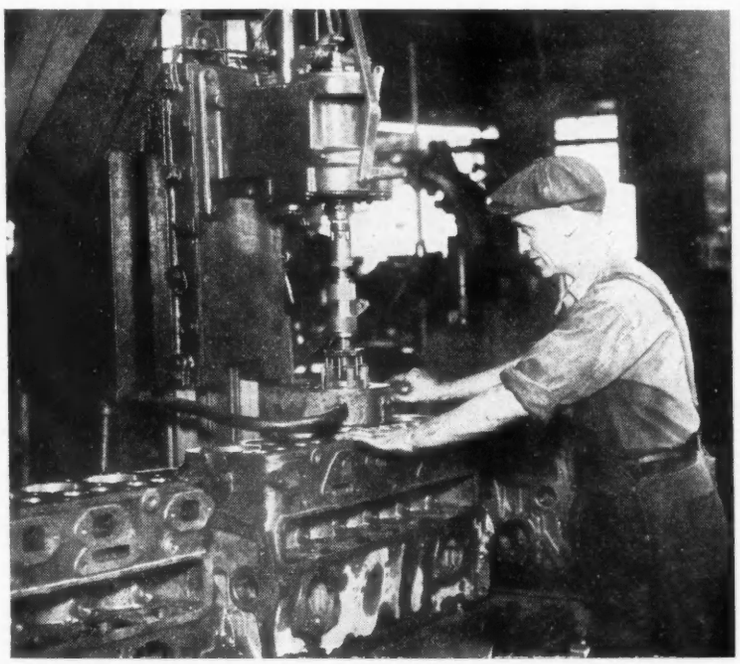
Another set of plates is provided for the drilling of four other blocks (cover side and valve side). The plate for the cover side has a total



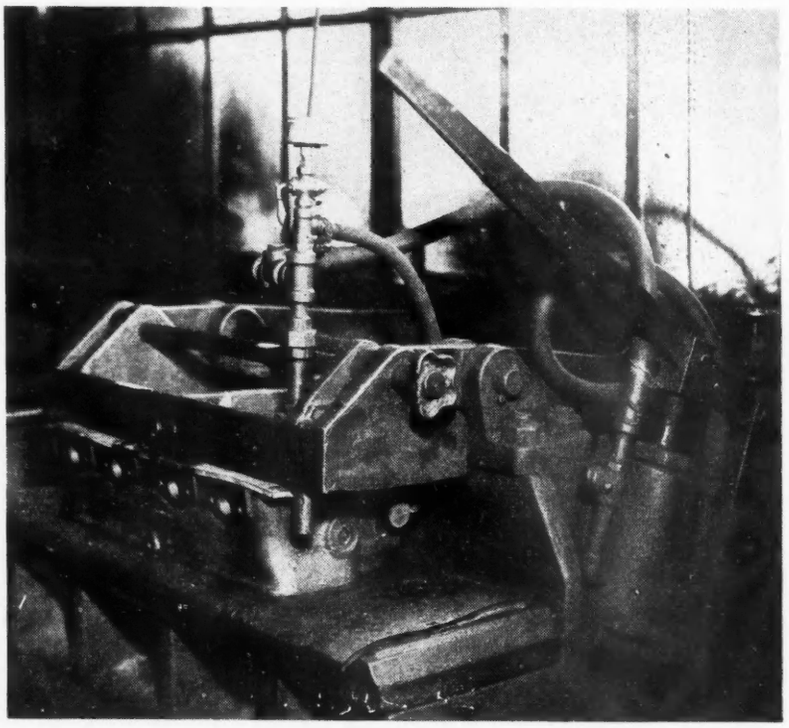
(Right) Rough and finish-milling cylinder blocks on the huge Ingersoll mills.

(Bottom right) New heavy - duty Sundstrand Rigidmil set up for milling a variety of manifolds.

(Below) Cylinder sleeves are finish-honed on this Moline honing machine. Note the massive guide fixture for the honing tool directly above the work.



Water test fixture for cylinder heads.



of 54 drilling centers, although the number of holes drilled in any one block varies from 21 to 45. The plate for the valve side has a total of 36 drilling centers, but the number of holes drilled in any one block ranges from 14 to 30. The third set of plates is provided for the drilling of two additional blocks (cover side and valve side). The number of holes drilled in any one block varies from 16 to 33. The plate for the valve side has a total of 24 drilling centers, but the number of holes drilled in any one block varies from 9 to 20.

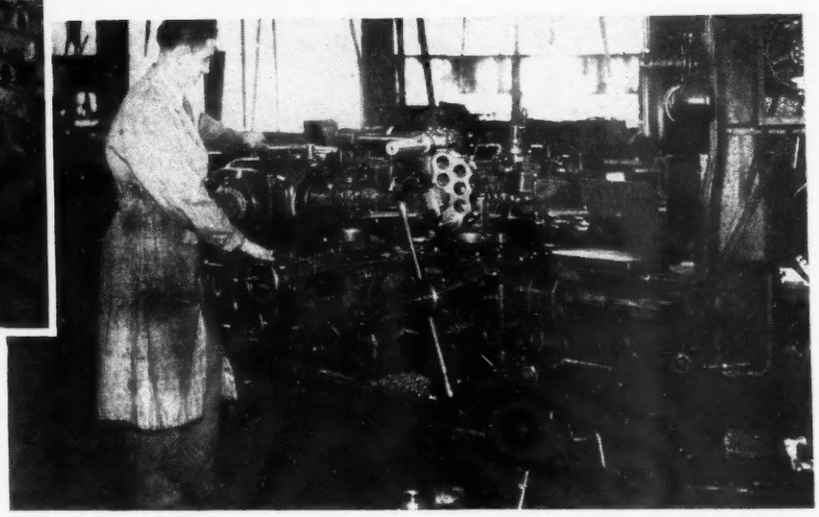
Cylinder boring presents somewhat more of a problem due to variations in bore spacing and bore diameters when coupled with the requirement of precise bore alignment and hole tolerances. For this reason, the blocks are shunted to a self-contained boring line with sufficient storage capacity on the gravity roll conveyor

(Below) American "Hole Wizard" radial drill on the cylinder head line. This is a close-up of the operation of roughing and finishing the air cell profile.

Factory Routing—Diesel Oil Pan

OPERATION	EQUIPMENT
Grind case contact	Diamond grinder
Drill case contact holes	Natco multiple-spindle drill
Mill oil drain cover opening and mill end	Ingersoll (2) spindle mill
Drill oil drain cover opening	Natco multiple-spindle drill
Drill (2) 9/16 in. holes	
Drill oil gage hole and spot-face, also (1) hole on angle	American radial drill
Inspect	American radial drill

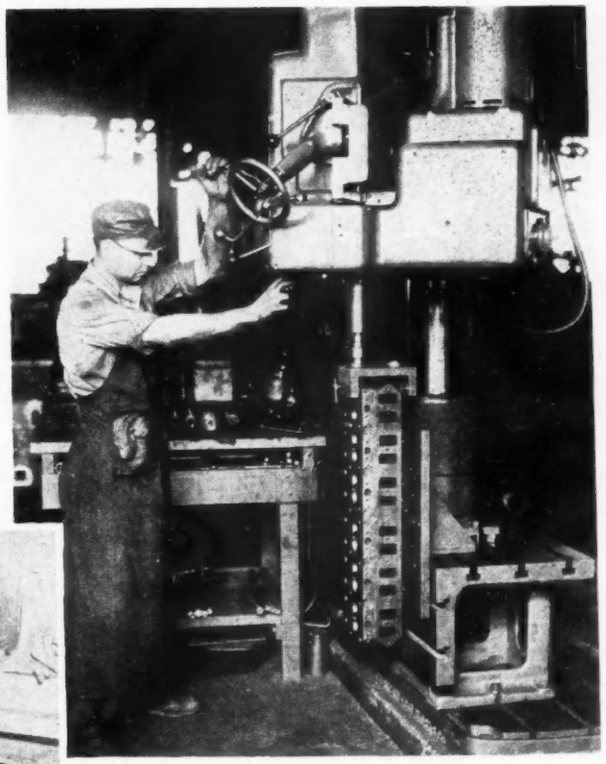
(Right) Close-up of new No. 5 Jones & Lamson turret lathe recently installed. Note the heavy pilot bars used for indexing each of the turret positions.



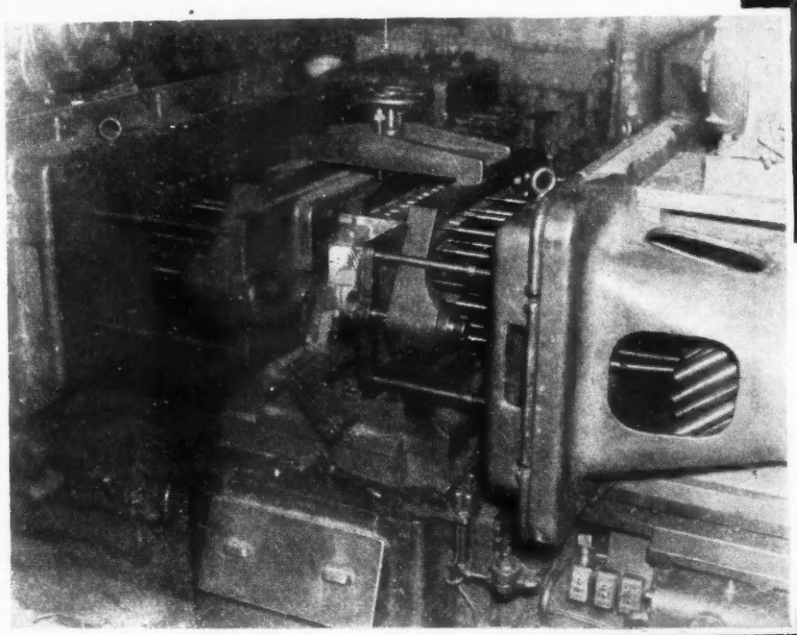
to provide the needed time interval without tieing up the flow of work. For boring they use a battery of the well-known Moline Hole-Hogs with adjustable spindle centers.

Flywheels may not be a problem in an automobile motor shop where only one or, at the most, two or three flywheels go over the line. At Buda it's a major problem, what with over 2000 variations in size and details to accommodate the special requirements of many customers. It was a big problem at the start to modify the conventional flywheel turning machines so as to provide the flexibility required for job-lot runs. Matters were further expedited by the design of special universal fixtures for simplifying the chucking of wheels in these machines.

However, in addition to arrangements for turning, there was the matter of drilling various holes in the periphery of the wheel to suit special needs. At first this was quite a chore, what with set-ups on single-spindle drills and the necessity for laying out each wheel separately. The solution was happily worked out at the time this article was being written, through the development of an ingenious work-holding fixture. It has provision for adjustment in all three planes, the fixture being precisely positioned by keyways for any type of wheel. A bushing bracket with removable bushings takes care

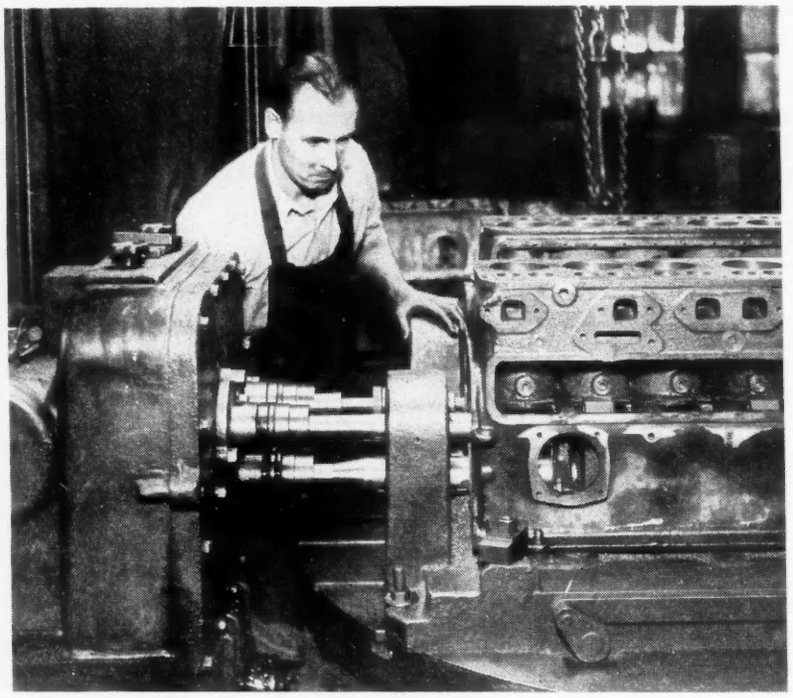


(Right) Another of the American radial drills—set up for spot-facing locating lugs.



(Left) New Natco horizontal two-way drilling machine takes all the blocks in the line. It is provided with three sets of interchangeable slip spindle plates as described in the article.

(Below) Battery of Moline Hole Hogs on cylinder head line set up for core drilling valve throats.



This Rockford boring machine is designed to finish bore cam and crank bores using special Davis boring bars with micrometer adjustment for the Carboloy-tipped fly cutters.

of different hole sizes; a built-in indexing head with infinite adjustment for radial displacement takes care of spacing. This fixture, in combination with a single-spindle drill, handles all the variety implied in 2000 flywheels, with almost ridiculous ease.

A connecting rod line tooled for low cost production on 24 different forgings is another example of universal tooling for precision work. Increased production on the seven different precision bearing rods is responsible for the several new machines recently installed. A No. 223 Gardner disk grinder for finishing the cap and rod contact face; a Leland-Gifford 4-spindle step driller for the oil line drilled through the rods; and an Ex-Cell-O 2-spindle precision boring machine for finishing the crank and pin end simultaneously—are the latest additions in this department.

Second Floor Machine Shop

Most important activity on the second floor is the machining of standard cylinder heads, diesel heads, oil pans, housings, and cases of every description. This department bears its share of the problems of job-lot production when you consider that one machine line has been set up to handle a variety of no less than 14 different gasoline and Diesel engine overhead valve heads, and 76 flat type heads, excluding service requirements.

It might be mentioned at this point that Buda has found it increasingly desirable to use nickel chrome alloy iron for case castings and various other parts. On light sections of this harder iron that might be distorted under heavy cuts, the customary milling machine operations have been eliminated. They have installed a Diamond face grinding machine to handle roughing and finishing operations. This one big machine, fitted with a universal holding fixture, takes all the cast iron oil pans in the line. O. S. Walker has supplied a special magnetic chuck that is fitted on the machine table for handling bell housings and other casting that have flat parallel faces.

To show tangibly the nature of

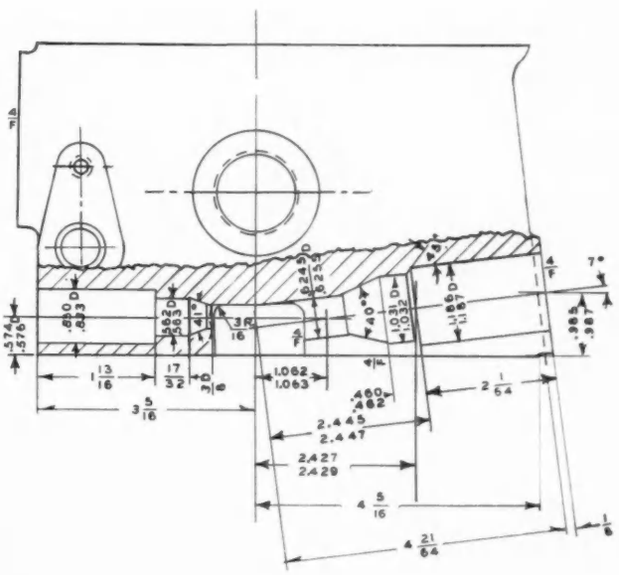
Factory Routing—Connecting Rod

OPERATION	EQUIPMENT
Inspect and check weights	
Straddle mill both ends	Cincinnati hydromatic mill
Grind both ends one side	Blanchard grinder
Drill pin hole	Foote - Burt six spindle drill
Broach pin hole	American vertical hydraulic broach
Mill locating bosses each side crank end	18 in. Cincinnati automatic mill
Bore and elongate bore crank end	Foote - Burt six spindle drill
Drill and ream bolt holes	Natco multiple spindle drill
Split mill cap from rod and mill bolt lock	Cincinnati hydromatic mill
Drill oil line through rod	Leland-Gifford four spindle deep hole driller
Spotface bolt holes, rod and cap	Avey two spindle drill
Grind rod and cap for contact	Gardener disc grinder
Mill precision bearing lock	Hand mill
Chamfer bolt holes, rod and cap	Avey two spindle drill
Assemble rod and cap	
Semi-finish bore crank end	Rockford single spindle drill
Chamfer crank end both sides	Rockford single spindle drill
Grind crank end both sides	Blanchard grinder
Precision bore pin and crank end	Ex-Cell-O Precision two spindle boring machine
Disassemble rod and cap and assemble precision bearings	
Press in bushing	Arbor press
Drill and assemble dowel pin	Avey two spindle drill
Single blade ream	Single spindle Rockford drill press
Diamond bore bronze bushing pin end	Coulter two spindle diamond boring machine
Inspect	

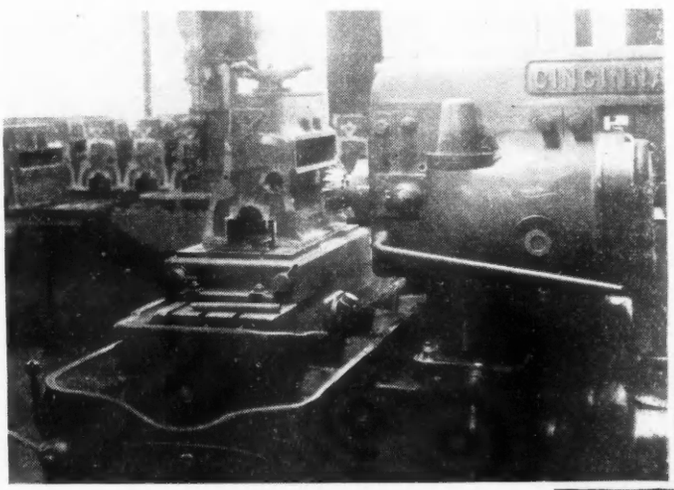
Cylinder barrels are finish-bored on this Foot-Burt machine.

the work involved in the production of Buda Diesel engine heads, we have reproduced elsewhere the routing of a small Diesel head, as well as sketch of one section—the section through the air cell cavity which houses the very heart of the combustion principle. Note particularly, the nature of the limits on hole size and the precise alignment of the air-cell profile with the fuel nozzle hole.

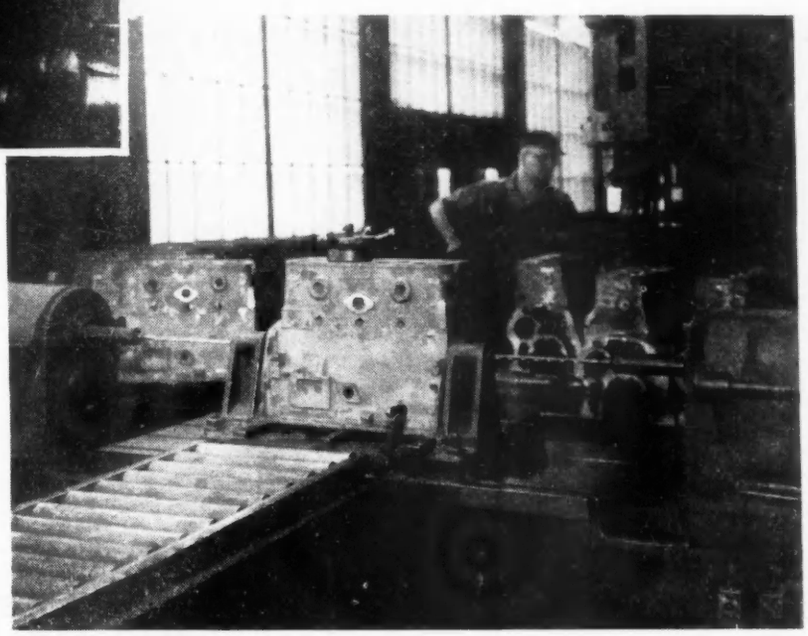
A battery of new American radial drills of the type used in tool rooms was recently installed to take care of Diesel head production, each head going through a number of separate single-spindle operations before completion. As a matter of interest, we direct your attention to the sketch showing the tool layout for the air cell cavity. This indicates the five separate multiple tools and set-ups required to finish this cavity within the required limits of alignment, diameter, and surface finish.



Section through the nozzle and air chamber of a Buda engine showing the close tolerances allowed.



Plain Cincinnati mill is used to mill pads on both sides of case.



(Right) Rockford drilling machine is used for drilling the main oil gallery from both ends, as shown.

Third Floor Machine Shop

On the third floor are concentrated the entire facilities for general machine shop work on the variety of small miscellaneous parts produced for the entire line of engines. Because of the great variety of parts, as well as the relatively small volume for each run, this department has been separated as far as feasible into specific machine functions such as —milling, drilling, grinding, etc. In the rear there is a large screw machine section with automatic lathes and screw machines, turret lathes, etc.

A part of the expenditure in the current modernization program is evidenced here. We noted, for example, a battery of two high-speed, automatic 18-in. Cincinnati milling machines; a huge Cleveland Model K, 2⅝-in., four-spindle automatic; and three of the very latest type turret lathes. The latter comprise a No. 5 Jones & Lamson machine, and a No. 5 and a No. 1-A Warner & Swasey. Both represent the very latest examples of the art, incorporating individual pilot bars which register each turret station with the head to assure perfect alignment.

This department is justly proud of several particularly difficult machining jobs, one of which is the air-cell, which is completely blanked and turned on one of the turret lathe set-ups.

Summary

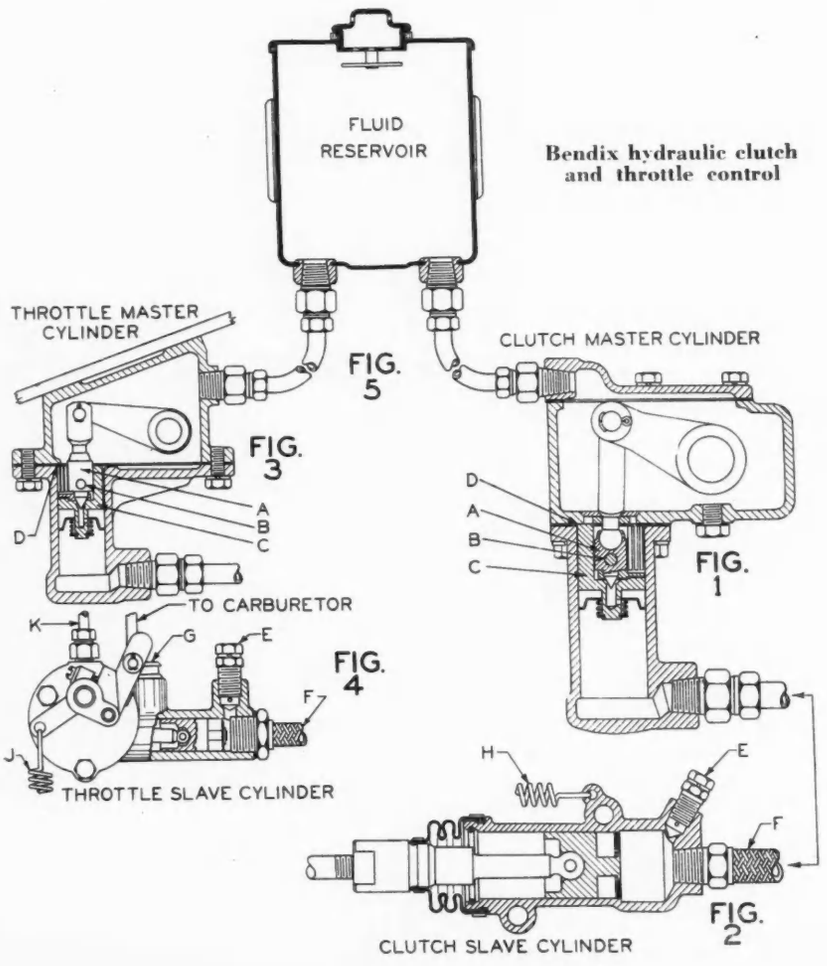
The foregoing is a brief high-spotting of an operation which holds much of interest to production men in the automotive industry. It is definitely representative of the manufacturing problem of the great majority of parts makers. And from that viewpoint, Buda is performing an excellent service to the industry in making public its solution of the problems of job-lot production.

Flexibility is perhaps the outstanding attribute of the operation. It is achieved first by a rational approach to the selection of unit-type and universal machine tools; and then by supplementing machine functions with rapidly adjustable universal holding fixtures.

Their approach to work routing of diversified production should be of great value to production men faced with similar situations.

Bendix Hydraulic Clutch and Throttle Controls

BENDIX PRODUCTS CORP., South Bend, Ind., is now supplying hydraulic clutch and throttle controls to replace mechanical linkages on buses with rear-mounted or midship powerplants. In such powerplant installations, owing to the long distance between the driver and the engine (sometimes as much as 25 ft.), a mechanical connection is not very satisfactory.



Bendix hydraulic clutch and throttle control

The Bendix clutch control consists of a crank-type master cylinder (Fig. 1), and the clutch pedal is either mounted directly on the shaft of the master cylinder or is connected to it through a linkage. Inside the master cylinder there is a return stop. The "slave unit" (Fig. 2) on the engine is connected to the master cylinder by a ½-in. copper-pipe line, with a section of flexible hose at the engine to take care of engine movement.

The throttle-control master cylinder (Fig. 3) also is of the crank-type; it is mounted under the floor of the bus and connects to the accelerator pedal through a crank and rod. A ⅜-in. copper-tube line is run to the throttle slave unit (Fig. 4), which also has a flexible hose connection at the engine. A loose-link crank on the slave unit permits adjustment of the carburetor without removing it, and the spring return for the slave unit is separate from the carburetor return spring.

The two systems are serviced through a single supply reservoir (Fig. 5) at the highest point, and filling is accomplished from the low or slave-unit end.

It is claimed for this control that it is smooth and dead-beat, and that the power required for operation is reduced by from 20 to 40 per cent, depending on the distance and the number of bell-cranks used in the mechanical hook-up.

Just Among Ourselves

Time: 1938

AS time turns the corner into 1938, the thoughts of most of us turn backward and forward, creating a sort of tug-of-war very conducive to reminiscence and forecast. To an editor, 1938 means about 260 working days divided by 52 issues of this magazine, and because we have been giving a great deal of time to planning that those next 52 issues shall be tied very closely to the contemporary problems of the automotive industry, we prefer to talk about that.

To us, it seems that Pontiac's Simpson has best keynoted the tone of 1938, so far as this industry is concerned. It will be a year which takes aggressive planning and aggressive selling for every organization which plans to get its share of the market. Those organizations which do a good job during the first half of the year will, we hope, reap rich rewards in the second half with the easing of the downward trend in industrial production.

Merchandising, selling, management functions will be most important and to these aspects of the industry we shall give dominant importance during 1938 in *Automotive Industries.*

These are hurrying years. The ticking of the clock becomes louder and reminds us that every minute must count for progress. It's 1938. Let's move!—H.H.

The Effects of Altitude on Compression Ignition Engines

DURING the latter part of 1936 the National Advisory Committee for Aeronautics conducted a series of tests at its Langley Field laboratories to determine the effects of altitude on the performance of compression-ignition engines. Tests were made on a single-cylinder displacer-type 5 by 7-in. engine operating at 2000 r.p.m. under simulated altitude conditions and various combinations of inlet-air temperature and pressure and exhaust back pressure. A report on these tests is presented in N.A.C.A. Technical Note No. 619, Compression-Ignition Engine Performance at Altitudes and at Various Air Pressures and Temperatures, by Charles S. Moore and John H. Collins, Jr.

Inlet-air temperatures equivalent to standard altitudes up to 14,000 ft. were obtained by using solid CO_2, Prestone solution, and kerosene in an air-cooling and dehumidifying apparatus. The inlet air was throttled and the exhaust-surge tank evacuated to give pressures corresponding to the standard altitudes. The inlet-air temperature, the inlet-air pressure, and inlet and exhaust pressures were also varied over a wide range of fuel quantities, from part load to maximum load.

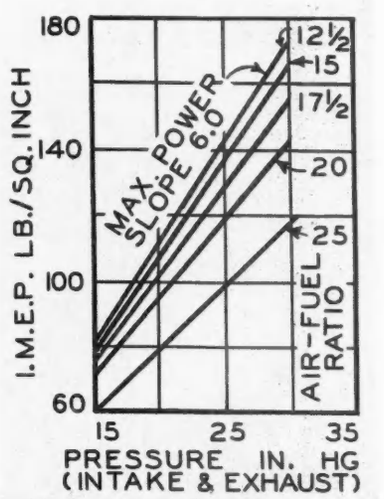


Fig. 1—Effect of inlet and exhaust pressure on indicated mean effective pressure over a range of air-fuel ratios with inlet-air at a temperature of 82 deg. Fahr.

All changes in altitude are fundamentally changes in air density as a result of changes in temperature and pressure. These factors are present regardless of supercharging, and the scope of the tests was therefore broadened to include the effect of a wide range of temperatures and pressures of the inlet air.

Analysis of the results under varying conditions of inlet-air temperature, inlet-air pressure and inlet and exhaust pressures indicated that engine performance cannot be reliably corrected on the basis of either inlet-air density or weight of

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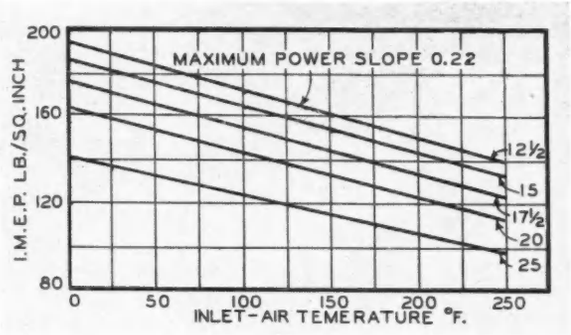

Fig. 2—Effect of inlet-air temperature on sea-level performance over a range of air-fuel ratios.

air charge. It was found that the engine power increases with the inlet-air pressure and decreases with the inlet-air temperature in very nearly straight-line relations over a wide range of air-fuel ratios.

The effects of inlet-air pressure and inlet-air temperature on the indicated mean effective pressure of the engine with various fuel-air ratios are shown in Figs. 1 and 2 respectively.

Previous reports of the altitude performance of aircraft compression-ignition engines have indicated that this type of engine loses power much less rapidly with increasing altitude than does the carburetor engine. The authors say it is possible that this conclusion was drawn because the engines were operated with excess air at sea level so as to give a clear exhaust; whereas with increasing altitude the air-fuel ratio was decreased toward maximum power, at the expense of a smoky exhaust. They point out that a comparison based on these conditions is unfair to the carburetor engine. Results obtained by them in this investigation showed that for the same inlet-air conditions, the performances of the two types of engines are approximately the same.

Owing to the decrease in the air charge with increase in altitude, the motoring compression-pressure and the friction m.e.p. decrease. The mechanical efficiency also decreases, because the b.m.e.p. decreases much faster than the friction m.e.p. The low compression pressure of 290 lb. per sq. in. at 14,000 ft. resulted in an increase in the ignition lag from 11 to 21 deg., the rates of pressure rise became extremely high, and engine operation became rough.

In the case of a supercharged engine, full blower pressure can be used at sea level and for any length of time, as no limitations are imposed by detonation or preignition characteristics of the fuel. With sea-level exhaust conditions and with constant inlet air temperatures of 87 deg. F., the power increases quite steadily with boost pressures, but for the pressure-rise type of combustion, upon which the test engine operates, it is necessary to increase the maximum cylinder pressures in order to obtain the maximum increase in power from the higher boost pressure. Engine operation was very smooth under boosted conditions, but the power was not quite maximum, as the maximum cylinder pressure was limited to 1100 lb. per sq. in. at 20 in. boost. The fuel consumption decreases for practically all fuel quantities with increase of

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boost pressure. No corrections of output were made to a multi-cylinder basis, nor for the power required to drive the supercharger, factors that tend to cancel each other.

The following conclusions were drawn from the results of the tests:

1. The altitude performance of an unsupercharged compression-ignition engine compared favorably with a carburetor engine; the low temperatures of altitude were especially important in maintaining the power at altitude of the compression-ignition engine.

2. The sea-level performance of this unsupercharged compression-ignition engine cannot be accurately corrected on the basis of air density or weight of air charge for differences of air temperature and pressure. Maximum performance varied differently from part-load performance with air pressure and temperature changes.

3. Maximum sea-level unsupercharged performance of this compression-ignition engine can be corrected, when maximum cylinder pressure does not limit output, as follows:

For each inch of Hg increase in inlet-air pressure with constant sea-level exhaust pressure, add 7.4 lb. per sq. in. indicated or brake mean effective pressure.

For each inch of Hg increase in inlet and exhaust pressure, add 6.0 lb. per sq. in. indicated or brake mean effective pressure.

For each deg. Fahr. increase in inlet-air temperature, subtract 0.22 lb. per sq. in. indicated or brake mean effective pressure.

4. Maximum sea-level boosted performance can be corrected as follows:

For each inch of Hg. increase in inlet-air pressure with conservative maximum cylinder pressures, add 4.0 lb. per sq. in. indicated or brake mean effective pressure.

For each inch of Hg increase in inlet-air pressure with unlimited maximum cylinder pressure, add 5.0 lb. per sq. in. indicated or brake mean effective pressure.

5. Reduced exhaust back pressure increased engine power slightly, while increased exhaust back pressure decreased engine power at an increasing rate.

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Rayon Cord Tire

A truck tire with a cord fabric made of rayon, instead of cotton, has been placed on the market recently. It is claimed for this new tire that in sustained high-speed services over long distances, and under heavy load, it gives a mileage life several times that of cotton-fabric tires under similar conditions. The price of these rayon-fabric tires is at present about 25 per cent greater than the price of corresponding tires of cotton fabric. Both the fabric and the rayon itself are said to be of a highly specialized type and it is therefore possible that the cost of the fabric to the tire manufacturer will be reduced in time. The particular virtue of rayon for this service is said to be that it is more heat-resistant than cotton.

Exhaust Analysis

In a "Note" to the Academy of Sciences by A. Maillard and R. Friedrich it is stated that by partial condensation of exhaust gases from a gasoline engine they proved the presence therein of compounds which have never been detected by ordinary methods of exhaust-gas analysis, namely, acids and aldehydes of low molecular weight, and phenol. This, they say, may explain the lachrymose properties of the exhaust from engines burning fuels containing a large proportion of alcohol.

Truck Tank Manufacturers' Complaints

PROBLEMS confronting the truck-tank industry were outlined to the American Petroleum Institute at its Chicago meeting by J. E. Julian of the National Truck-Tank Association. These problems, Mr. Julian said, are of three kinds, some resulting from practices of chassis manufacturers, others from demands made by the oil industry, and still others from unreasonable and conflicting restrictions imposed by regulatory bodies.

Tank builders, it appears, are greatly annoyed by lack of sufficient data on body-builders' charts or blue prints, the desirable data often missing including those relating to location of spring hangers, cross-members, mufflers, brake rods, air-brake equipment, etc. If the tank builder stops to obtain this necessary information, a delay in delivery results, and if he goes ahead without it, the tank may not fit the chassis properly, due to interferences. Another cause of trouble to the tank builder is lack of strict adherence to blue-print dimensions by the chassis manufacturer. For instance, if the over-all tire dimension is not mentioned, serious interference with wheel shields and skirting may result.

Chassis manufacturers also should give more consideration to the location of auxiliary equipment that must be installed by the tank builder. The latter often finds it necessary to relocate the muffler and air-brake equipment in order to be able to install the pump. Often the pump has to be mounted much lower than is advisable because the pump-drive shaft must be kept low to clear a brake rod or cross member.

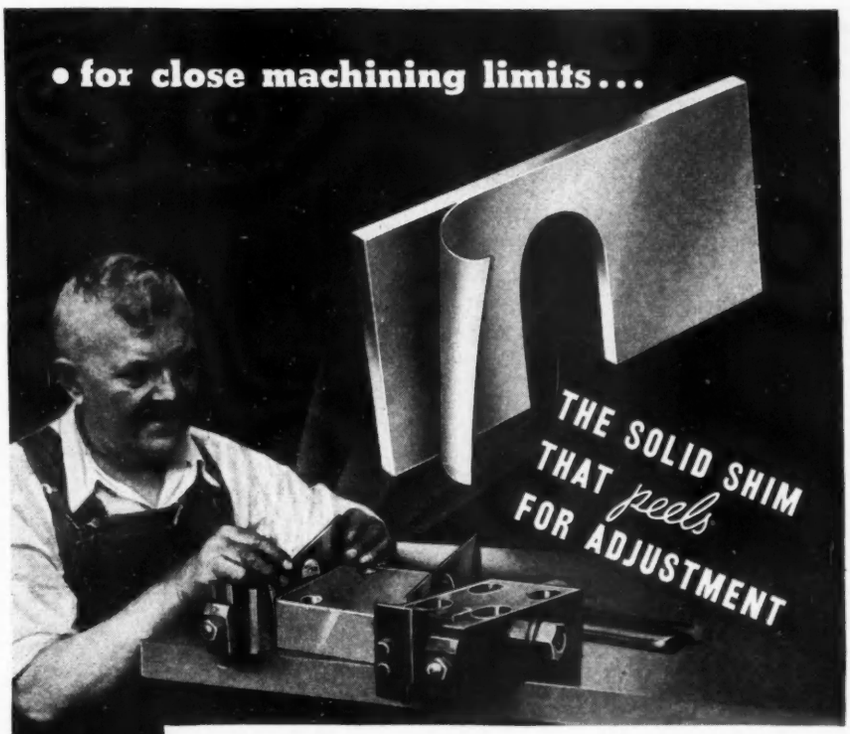
Chassis manufacturers seem to lose sight of the fact that in about 90 per cent of tank trucks there is need for a clear space outside the chassis from a point back of the cab to the wheels. Fuel tanks, battery boxes, and tool boxes are hung on the outside of the chassis frame. The chassis is sent to the tank manufacturer for the tank mounting, and he must either remove these obstacles at his own expense or wait a week or more for the chassis manufacturer to decide who is to make these changes.

Cabs are being made lower in order to improve appearances, but it is a distinct problem to the tank manufacturer to hold the top of the tank even with or below the top of the cab without making the tank so long that it results in poor weight distribution.

Proper drainage of the pipe lines is required in a tank truck, and in order to make this possible it is often necessary to mount the tank from 3 to 6 in. higher in front than at the rear. This method of mounting gives an unsightly appearance to the completed job, increases the weight of the tank mounting, and complicates fabrication problems. To aggravate the matter, many chassis manufacturers cannot give proper information regarding frame pitch.

For the sake of appearance, the bottom line of the skirting on the truck tank should be on a level with the bottom line of the running board. If a standard were established for the vertical distance from the running board to the top of the truck frame, with a reasonable plus and minus tolerance, tanks could be interchanged with various trucks of like C.A. (cab-to-axle) dimensions and still retain the proper skirting line.

There is a lack of proper capacity ratings for front and rear axles. For instance, tanks of identical capacity and specifications may be ordered for



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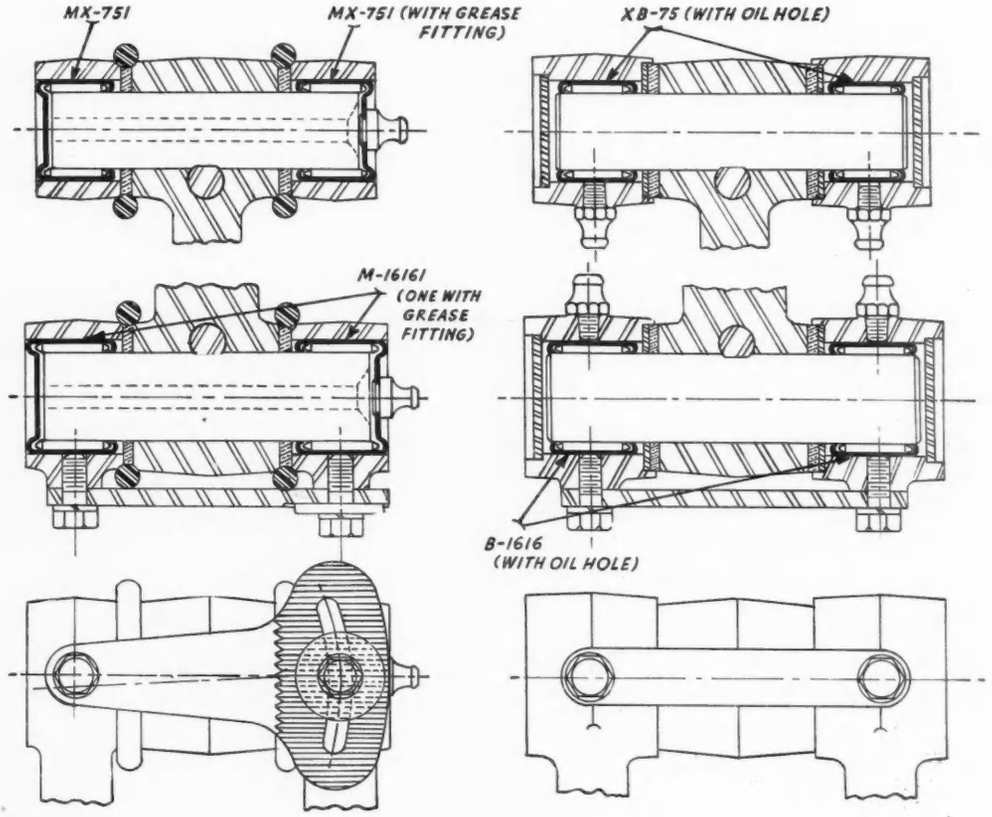
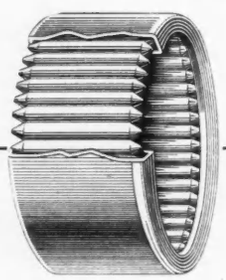


NUMBERS ARE TORRINGTON NEEDLE BEARING CATALOG NUMBERS FOR STANDARD TYPES AND SIZES



STEERING KNUCKLE SUPPORT ARM

...a typical application where this new type anti-friction bearing offers unusual advantages

Combining the features of an anti-friction bearing into a single compact unit that requires very small space—often less than for a simple bushing—the new Torrington Needle Bearing is ideally suited to applications of the type shown here.

In reduction of unsprung weight through simplification of housing structure and by the small compact size of the bearing itself, this new Needle Bearing contributes to better design. Likewise, the high unit capacity of the Torrington Needle Bearing—its ability to take unusually high radial loads—makes it ideal for automotive applications where service demands freedom from wear so that "shake" will be eliminated from front wheel assembly.

Another feature of great importance in this application is the ability of this Needle Bearing to operate for long periods with an absolute minimum of lubrication or other service attention.

The illustrations show the ready adaptability of the Torrington Needle Bearing to individual requirements.

Manufacturers interested in the advantages of this bearing for use in their own products are invited to work directly with the Torrington Engineering Department in developing designs and laying out applications. Further information is given in the Torrington Needle Bearing Catalog, available on request. Write for Catalog No. 7.

TORRINGTON
NEEDLE BEARING

The Torrington Company
ESTABLISHED 1866
Torrington, Conn., U.S.A.
Makers of Ball and Needle Bearings

two chassis of the same C.A. dimensions, but the axle-load recommendations may differ so much that it is necessary to make the tanks of entirely different proportions in order to achieve the proper weight distribution.

The S.A.E. standard for frame widths is not being adhered to. Frame widths range all the way from 32 to 38 in., and it is obvious that a tank built for a 32-in. frame width cannot be shifted to a truck of 38-in. frame width.

The location of the forward rear axle and the distance between the two rear axles in six-wheel trucks should be the same whether the truck is turned out as a six-wheeler by the chassis manufacturer or the third axle is installed later in accordance with C.A. dimensions for four-wheel trucks.

Mr. Julian expressed the view that it was wrong for certain oil companies to insist upon rigid specifications and designs of their own with respect to such features as bulkhead construction, type of mounting, size of manholes and outside diameter of tubing (rather than inside diameter). He felt that it should be left to the tank manufacturers to furnish the oil company with a tank which is basically sound in design, which will perform properly, and which will so much resemble a tank made by another manufacturer to the same specific design that to the layman they are identical tanks. Delivery terms should be made more liberal, for whereas some years ago a single shop drawing or specification sheet was sufficient for the construction of a truck tank, today, because of intracacies of design and equipment, one to two weeks' engineering and drafting and a dozen or more detailed prints may be required.

Although considerable work has been done by the A.P.I. Standards Committee for a number of years in an effort to standardize truck dimensions for a given C.A. dimension, 1000-gallon tanks are still being built for C.A. dimensions ranging from 84 to 102 in. It would be a great help to the tank industry if the oil companies would adopt certain limitations on C.A. dimensions for tanks of a given capacity.

Another problem that confronts the designer of modern tank trucks is that of combining utility with beauty. The truck must be equipped with an intricate piping system, a pump and a meter. All of this equipment must be arranged in the side compartments of the bucket box, and this is not an easy job. So the tank manufacturers, Mr. Julian said, appeal to the oil companies to allow them greater latitude in the interpretation of their specifications. They would like the oil companies to tell them their needs and allow them (the tank manufacturers) to work out the details.

New Fiat Aircraft Engine

It is reported that the Fiat company is trying out a new 18-cylinder air-cooled radial aircraft engine known as the Fiat A.82 R.C., which is capable of developing 1500 hp. This is an increase of approximately 50 per cent as compared with an earlier model.

Body Nomenclature

THE French Automobile Standards Office has tackled the subject of automobile body nomenclature and has decided that henceforth in France a closed vehicle with two doors and two side windows (in the doors) shall be known as a coupe; a closed vehicle with two doors and four side windows, as a coach; a closed vehicle with four doors and four side windows, as a berline, and a closed vehicle with four doors and six side windows, as a limousine.

YOUNG HEAVY DUTY RADIATORS

Standard equipment on White trucks, Young radiators are designed by experienced engineers for both strength and modern appearance. Built in Young shops to withstand the rigors of the most stubbornly hard conditions, they combine strength, durability and economy with the highest efficiency. They are backed by a most complete Engineering Staff and constant research in heat transfer fields.

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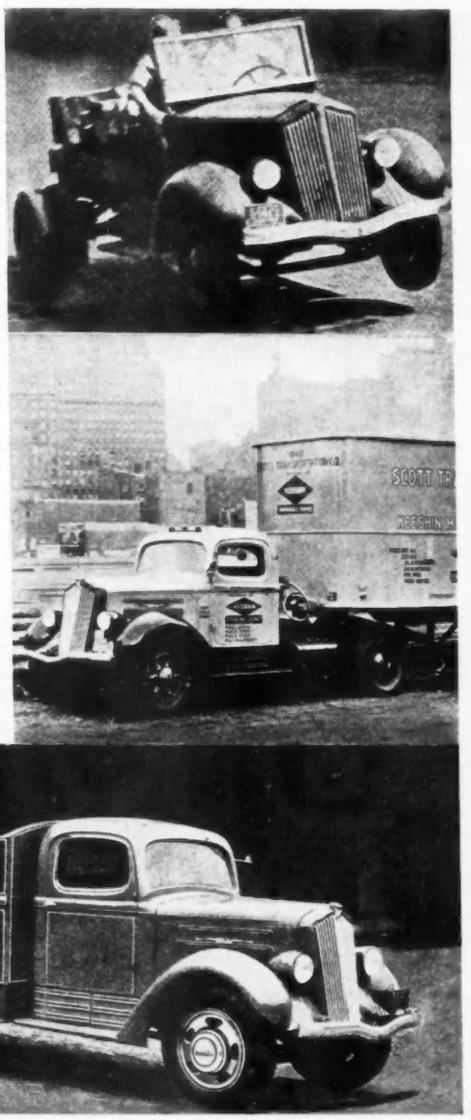


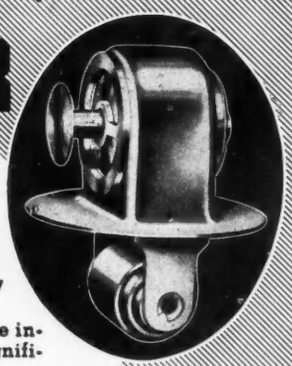
YOUNG RADIATOR COMPANY
RACINE, WISCONSIN

What Does "Air-Conditioning" Mean?

In a paper on Air-Conditioning read before Section G of the British Association for the Advancement of Science, Oscar Faber, D. Sc., discussed the meaning of the term as follows:

"Air-conditioning may be defined as the art of altering the physical condition of air to that most desirable for some specific purpose. As a rule the modification required from its unconditioned state relates to, (*a*) temperature, (*b*) humidity, (*c*) cleanliness. When the temperature is merely to be raised and the consequent reduction of relative humidity has not to be corrected, the problem can be dealt with simply by heating. When, however, both the temperature and the quantity of moisture are to be raised in conjunction with the supply of air from a central plant, then the system is generally known as ventilation. For complete control, however, the temperature and humidity should be capable of being reduced as well as raised, and the word air-conditioning should be reserved for this complete provision if confusion of terms is to be avoided. This generally involves the use of refrigerating plant or some alternative system of reducing humidity, such as silica-gel. It must, however, be admitted that this definition is by no means universally recognized and that air-conditioning is often used in a much looser sense as covering installations which are merely heating installations or those in which the air can be warmed and passed through a mist chamber without any means of reducing the humidity."

An Extra Sales Point FOR YOUR CAR



● When a car manufacturer puts DOLE THERMOSTATS on his motors he ties up, primarily, of course with competent thermostat engineering by Dole's technical staff.

But the sales-minded men of the industry will also value the significance of Dole *advertising*.

More and more each year the name "Dole" and our connection with thermostats has been advertised, climaxing this year with over 20,000,000 repetitions of the message — Dole Hoseline Thermostats give quick heat and more heat from hot water heaters; also efficient motor temperature control.

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We also have full confidence in our ability to give you *thermostatic bi-metal as raw material*, in sheets, strips or coils—all heat treated and ready for assembly into your own devices.

DOLE Thermostats

Correction in Engineering Drawing Series No. 1

THE descriptive data supplied to us and published in connection with the reproduction of the Hall-Scott engine drawing (AUTOMOTIVE INDUSTRIES, Sept. 18) were incorrect and we submit herewith a description which supersedes the original information.

The engine shown in cross-section on pages 397-398 of the Sept. 18 issue was designed for use in motor coaches. Its 6 cylinders are disposed horizontally, and the height of the engine is only 18 7/16 in., so that it is mountable amidships under the floor of the coach.

With a bore of 4¼ in. and stroke of 5 in., making the total piston displacement 425 cu. in., the engine develops 124 b.hp. Cylinder sleeves of 4½ in. bore can be fitted to the same cylinder block, providing piston displacement of 477 cu. in. Thus equipped, the engine develops 139 b.hp. Maximum power is developed at 2600 r.p.m.

Cylinder sleeves are of the wet type and are held in place by the cylinder head. Valves and camshaft are mounted on the cylinder head. Main bearings are of cadmium-silver alloy, 3-in. in diameter. The oil sump, which holds 4 gal. of oil, is integral with the cylinder block.

Accessories are located at the front end or underneath the cylinder block for convenient servicing from a pit. Delco 12-volt ignition and starting system is standard equipment. The carburetor is a Zenith 1¾ in. balanced type. The manifold is of exhaust-heated type with a seasonal adjustment.

A 7½ cu. ft. air compressor is mounted on the case cover which provides access to crankshaft and main bearings. The compressor is driven from the crankshaft, and is oiled from the engine pressure oiling system. A mechanical governor is provided. Oil pump, oil filter and oil temperature regulator of Hall Scott design are provided.

BILL SPIVVINS, METAL WORKER, SAYS:

"Give Me Stainless"

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"I'VE been working in this shop for a good many years, and if I do say it myself, I know metals. I know that just about the only metal that will stand up under all kinds of bad weather and foul treatment is stainless steel.

"That's why I want stainless steel trim and hub caps on the next car I buy. Nobody has to tell me how much hard work it will save. I've already spent too many hours polishing off the rust from the bright metal parts."

Bill Spivvins is right. Stainless steel is the only commercial metal known that will never rust, never pit, never tarnish.

He and 562,341 others work with metals every day of their lives. No one needs to tell this vast army of potential car buyers how much stainless steel trim will mean to them, in terms of extra value in the cars they drive. Manufacturers who take full advantage of this appreciation of the benefits of stainless steel will be placing their dealers in position to net a larger share of new car sales to this important branch of the 1938 automobile market. ***Give the car buyer more stainless steel and he'll be glad he bought your car.***

73% of Auto Show Visitors ask for Stainless Steel Trim

Surveys conducted at six of the nation's largest Auto Shows indicate that the buying public is overwhelmingly in favor of Stainless Steel Trim for their cars. Here are the actual figures:

BOSTON	80%
BUFFALO	71%
CHICAGO	74%
MINNEAPOLIS	89%
NEW YORK	53%
PITTSBURGH	67%
TOTAL	73%

These figures are the compiled results of hundreds of interviews made by a private investigating agency of recognized standing. They show how thoroughly conscious of the benefits of stainless steel are the car buyers of today. They show why manufacturers who standardize on stainless steel trim are giving their dealers a valuable sales advantage that will help them sell more cars.

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